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THE SCOTTISH GEOGRAPHICAL MAGAZINE

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Yours very truly
Sven Hedin

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

DR. SVEN HEDIN,

Livingstone Medallist of the Royal Scottish Geographical Society.

SWEDEN has much reason to be proud of Dr. Sven Hedin as one of the most accomplished of modern travellers. From boyhood he showed that his natural bent lay in the direction of geographical discovery. When only fifteen or sixteen he made a series of maps to illustrate the path of every explorer of the Arctic regions, and the drawing and execution of these maps were extremely good. Later on he pursued a course of geographical literature, and finally completed his studies at Berlin under Baron von Richthofen. In 1887 he wrote an account of his experiences in travelling through Trans-Caucasia to Persia, Mesopotamia, and home by Turkey and Bulgaria. In 1890 he was sent by King Oscar on a mission to the Shah, and published next year an account of his journey. In 1891 he translated into Swedish General Prjevalsky's travels in Northern Asia. In the following year he published an account of his travels in Eastern Persia and through Bokhara to Kashgar, with many clever sketches by himself, as he is an accomplished draughtsman. All this was an excellent training for the infinitely more arduous journeys he was about to undertake.

In February 1894, with twelve horses and four men, Dr. Hedin began a dangerous journey across the Pamirs from Tashkend to Kashgar in Eastern Turkestan. The great cause of danger is the violent snowstorms, the deep drifts, and the intense cold, which registered over -24° F. in a tent full of Kirghiz. Outside, the thermometer on one occasion fell to $-36{\cdot}4^{\circ}$ F. If a caravan is overtaken by a snowstorm and any member strays from it, he is inevitably lost and frozen to death, for the frightful howling of the storm is so terrific that no voice or even rifle-shot can be heard.

One great object of the expedition was to explore the glaciers of the huge Mustagh-ata (the father of ice mountains), which towers to the

enormous height of over 25,500 feet. To the natives it is an object of religious awe, and many fantastic legends cluster round its snow-clad heights. The northern top, with an elevation of over 19,600 feet, was successfully ascended in August, and a number of glaciers were carefully mapped and found to be retreating gradually. The great hardship that this entailed may be judged from the fact that the mapping sometimes had to be done at an elevation of from 18,000 to 19,000 feet above the sea. After spending the winter in Kashgar, in February 1895 Dr. Hedin started eastwards to explore the Takla-makan desert in the hopes of finding traces of ancient civilisation, and then intended to penetrate into Tibet. Unfortunately this journey turned out disastrously, and it was almost by a miracle that the hardy traveller escaped with his life. For the first fortnight all went well, till the expedition reached a region of desolate sandhills as far as the eye could reach. The air was filled with sand, and after three days the camels began to die of thirst. Two days later the party were awakened by a sandstorm which buried the whole camp. Even in the daytime it was as dark as night. The last sheep was killed in order to drink its blood, and the end of the whole expedition seemed very near. Dr. Hedin with one of his men then started off eastwards on foot, and after intense suffering from thirst struck the dry bed of the Khotan river. He was so exhausted by this time that it took him five hours to go a distance of scarcely two miles. All of a sudden he heard a duck splashing in water, and he was saved. Filling his boots with water he returned to his native servant and so saved his life. For the next three days he walked alone till he found some shepherds, and had to support life meanwhile by eating grass and tadpoles. After this disaster, in order to make good his losses, Dr. Hedin was obliged to return by a more northerly route to Kashgar.

In December 1895 he left Kashgar with the intention of making Khotan, which lies three weeks' journey to the south-east, a headquarters for a further exploration of the great sandy desert, and of clearing up the dispute between Prjevalsky and von Richthofen regarding the position of Lob-nor. In traversing the Takla-makan desert, which took six weeks, he encountered on more than one occasion a buried city, the wooden timbers of which slightly emerged above the sand. Excavation led to the discovery of a manuscript, plaster casts, and artistic mural paintings—women praying, Buddha sitting on the cup of a lotus, and ornamental designs. There is every reason to believe that the city is anterior to the Arab invasion in the eighth century. This journey across the Takla-makan desert was the first ever undertaken by a European traveller. On reaching Lob-nor, Dr. Hedin ascertained that von Richthofen and the Chinese were right and Prjevalsky wrong. There is a large lake, though shrunken in size, which corresponds with the Lob-nor of the Chinese. The lake discovered by the Russian traveller lies south-east of the true Lob-nor, and is of quite recent formation. On leaving this district a journey of 600 miles took him back to Khotan, partly by the route traversed by Marco Polo. Here he recovered a large part of his baggage that had been lost in his first expedition across the desert, including his photographic apparatus.

Unfortunately all the negatives had been abstracted by the natives to use as window-panes.

Great preparations were here made before crossing the great Kuen-lun range and thence by way of Koko-nor to Pekin. An idea of the hardship undergone during this long march may be gained by the fact that out of fifty-six baggage animals no less than forty-nine died on the road. Where pasture was scarce or wanting, they died at the rate of one or two a day. The Kuen-lun was crossed by a pass about 16,000 feet above the sea, and a range more to the south was traversed by a new pass 17,000 feet high, a few miles east of where it had been crossed by Littledale. The rarefied air had a very injurious effect on the men. During the first weeks every one was ill and complained of headache. The Chinese interpreter was half dead and had to be sent back to Khotan. In spite of these drawbacks and the desertion of some of his men, the work of mapping, surveying, and photographing was never discontinued. For two whole months the party wandered across the plateau of Tibet without seeing a single living being, and the caravan had dwindled to an alarming extent. At last they came upon a woman and a small boy who were tending yaks and lived in a tent of mere rags. Afterwards they encountered many Tsaidam Mongols who were friendly and hospitable, but the party had to be constantly on its guard against the Tanguts, who were always ready to attack. The French traveller Deutreiul de Rhins had been killed by them in the neighbourhood, and Prjevalsky had a battle with three hundred Tangut robbers, though he was able to beat them back. After crossing the southern Koko-nor mountain range the party at last reached Koko-nor lake, still 1000 miles from Pekin. In January 1897 Dr. Hedin enjoyed a well-earned repose from his adventurous travels in the Chinese capital before returning to his native country.

Between 1899 and 1902 Dr. Hedin explored the Tarim river from near Yarkand to its lower extremity, and has mapped it in about 100 sheets. This survey included a part of the desert of Gobi that had never been visited before. The problem of the position of Lob-nor is now definitely solved. The ancient and historical lake is exactly where von Richthofen placed it, though the basin is now dried up. Dr. Hedin found on its northern shore ruins of towns, settlements, and temples, as well as a number of manuscripts written on wood in Chinese characters, dating from 264 to 465 A.D. Along the same northern shore were found indications of a great caravan route.

The first expedition to Tibet was made in the latter half of 1900. A large part of the caravan and one man perished under the incredible hardships undergone while traversing this inhospitable and lofty region, destitute of all vegetation. The positions of many salt- and fresh-water lakes were determined and many soundings were made. The results of this excursion were embodied in a map of 150 sheets.

The longest journey through Tibet was begun in May 1901. Two attempts to enter Lhasa proved unsuccessful owing to the hostility of the Lamas. The results of this last journey are recorded on a map of 370 sheets. Leaving the survivors of his caravan to rest at Leh, Dr.

Hedin took a run down into India, where he was most hospitably received by Lord Curzon and by many other English friends. In April 1902 he left Leh, crossed the Karakorum pass to Yarkand, and then *viâ* Kashgar and the Caspian finally reached Stockholm in June 1902.

The results of this last journey from 1899-1902 are thrice as rich as those brought back in 1893-1897. The cartographical material covers no less than 1149 sheets, and the position of 114 places were determined astronomically. A complete meteorological journal was kept without intermission. Over 2000 photographs were taken. Anatomical collections of the higher animals were made, as well as a large collection of plants. The geology of the country is illustrated by 700 petrological examples, and a large number of archæological treasures were recovered from the buried cities.

THE MUSSULMAN SUBJECTS OF RUSSIA.

By Victor Dingelstedt,

Corresponding Member of the Royal Scottish Geographical Society.

Geography and Religion.—"Geography," according to Dr. Hugh Robert Mill, "is the description of the Earth in relation to Man in all the bearings of that relationship" (*S. G. M.*, vol. viii. p. 88). Among these bearings there is one, produced by the existence of religious feeling, which, according to its character, exercises a conspicuous influence on the behaviour of man, his commerce, industry, arts, political and geographical distribution on the earth's surface. A particular creed may be of a greater moment for a classification of man, his hatreds and sympathies, than even racial or national distinctions, and therefore religious geography is quite as legitimate a part of geography as ethnography or political and commercial geography.

Religious geography, or the geography of religions, must not be confounded with ethnography, for a creed is to a certain extent independent of races and nationalities, and may even contribute to the effacement of these natural distinctions. The mode of religious thought is a potent factor in the destiny of men. Originating in the influences of the earth or environment upon the man's mind, and being more or less strong according to the grandeur of these influences, a creed determines in its turn men's physical and mental dispositions, creates bonds or antipathies among them, and like food, war, and labour becomes an instrument of their destiny.

The ignorance of, or indifference on the part of statesmen to, the prevalent mode of religious thought has done, and is still doing, much harm in the world; it is at the root of many evils, and much injustice, and hatred. The lamentable estrangement of people belonging to different

creeds, and the injury to progress and peaceful development which ensues is often due to the want of an unprejudiced study of what these creeds are, and what their geographical significance is.

There are in all six or seven principal creeds, which seem to satisfy the religious wants of humanity. But among these there are three, viz. Buddhism, Christianity, and Mohammedanism or Islamism, which dominate four-fifths of the total number of mankind, and command respect among people otherwise widely distinguished by race and nationality. There are 455 million Buddhists, 421 million Christians, and about 225 millions of Moslems.

These three principal religious groups of humanity have certain marked characteristics produced by their particular tenets, and the nature of the influences exercised on them by their geographical conditions. It would certainly be highly interesting to depict accurately each of these groups of believers, but the author has no such high ambition. He proposes only, after a rapid glance at the actual situation of the Mussulman world, to describe the principal groups of the Russian disciples of Islam, and to try to draw some conclusions about their mental condition, and the best mode of dealing with them.

The Mussulman World.—There is a curious contrast in the common judgment about this particular world, raising at once our abhorrence and our admiration. It is the Oriental world of our childhood, with its splendour, its mystery, its gorgeous feasts and ceremonies; the world of the thousand and one nights, with Harun-al-Rashid, and all its strange and delightful stories, the world of *Keif*, perfumes, odalisks, and countless wonders. And on the other hand it is, or it has long been for Christians, a world of corruption, licentiousness, dissoluteness, cruelty, and disgusting lasciviousness.

The actual fact is, that from its very foundation Islam and its founder have been always regarded as the greatest enemies of Christendom, and have been treated and judged with the most blind prejudice. Very instructive in this respect are the documents gathered by Compte Henry de Castries in his recent volume about Islamism (Paris: Armand Colin). The ideas of the Middle Ages about Mohammed and his teachings show to what an incredible extent erroneous judgments may prevail when dictated by religious passion.

Here is one instance among hundreds: The historian Ludolphe de Sudheim, after having interpreted the doctrines of the Koran in a most perverse manner, finishes his sentence thus: "*Hic omnia dorait et servavit perfidus Magumetus sordidus et immundus.*"

We are not so intolerant now as our ancestors were, and yet we find that even in our civilised world there are not many who are disposed to judge Islam with perfect fairness.

This creed is, however, the latest manifestation of a profound religious feeling among a well-endowed, poetical, high-spirited people; it contains high moral principles, recommends submission to God as creator of everything, exhorts to prayer, humanity, sober and virtuous life, and is not more antagonistic to the advancement of science and of well-being than any other religion.

The advent of Islam must be considered as one of the most important events in the history of mankind. It produced a new and powerful bond among men, and thus increased their sense of solidarity; it substituted for mere blood-relationship a more energetic agent in building the social structure, and it succeeded in satisfying that deep, though, may be, irrational feeling, which urges us towards a belief, and commands the submission of our reason. No other religion has spread with such a marvellous rapidity.

Originating among Arabs, and counting at the battle of Beder (624) scarcely 314 adherents, Islamism a century later crossed the Pyrenees, entered France, and conquered Syria, Persia, Egypt, and Barbary. The further extension of the teaching of Mohammed was checked, for the Christian world proved to be stronger; but even in our days it finds a vast congenial field for further success in the African continent and in Central Asia. It is still powerful in China, India, Turkey, Persia, North Africa, and it continues to gain ground in Russian Turkestan and the Transcaspian, and in Central Africa.

According to Leng, from the eleventh century up to our day the states of the middle Niger have remained the bulwark of Islamism, becoming also the centre of an advanced civilisation. "Between Sierra Leone and Egypt," says Mr. Blyden, "Islamism is the only intelligent, moral, and commercial power. It has taken possession of the most gifted tribes, and left its impression on their social life. Its adherents rule the politics and commerce of nearly the whole of Africa to the north of the Equator."

Islamism has become a universal creed, exercising a potent influence upon the mind of various peoples, from the refined Persian, noble Turk, and warlike Kurd, to the rough Nogaï and peaceful pastoral Kirghiz. It has given an original conception of the Superior Being, and has imposed on its adherents some formal duties more strictly binding than under any other religious creed, and given to the whole community of "Believers" a marked stamp.

It would be difficult to detail all the peculiarities distinguishing the Mussulman world and giving it its characteristics. We believe it to be in general sober, dignified, respectful of authority, inclined to meditation, indolent, courageous, fatalistic, having its virtues and its vices—the latter not in any way calculated to exclude a respect and admiration for the former.

Russian Mussulmans.—If it were not for the prohibition of wine, the great Russian empire, according to chroniclers, would probably be now a Mussulman power. But the Knias Vladimir objected to Russians not being allowed to drink wine, and the consequence is now that Mussulmans in Russia, though about fourteen millions strong, are reduced to a very inferior and subordinate position.

There are recognised in Russia (according to the census of 1897) 142 different nationalities or tribes, and of this number 42 are Mussulmans. We may divide them into the following groups, according to their relative importance and numbers:—

Russian Mussulman nationalities and tribes, according to the census of 1897.

Tartars,	3,897,512	Karapapakh,	24,134
Bashkir,	601,239	Bessermian,	10,979
Meshtcheriak,	161,216	Kurds,	124,414
Teptyars,	132,586	Caucasian Highlanders,	680,104
Turkoman,	272,242		
Uzbek,	183,436		10,407,741
Tadjik,	138,998	Semi-independent—	
Nogaï,	164,471	Bokhara and Khiva,	3,300,000
Kumyk,	158,347		
Yacutes,	230,769	Total,	13,707,741
Kirghiz,	3,637,394		

According to another estimate by provinces, the number of Russian Mussulmans is 18,000,000, distributed thus:—

European Russia,	2,800,000
Turkestan and Stepnoy,	7,207,972
Syr-Daria Territory,	1,500,000
Irans and Caucasus,	2,948,785
Bokhara and Khiva,	3,300,000
Total,	17,756,757

These estimates must be taken under reserve, official censuses in Russia being far from accurate, while Mussulmans do not like to be numbered. Uzbeks and Tadjiks, for instance, may be double the number given officially (*S. G. M.*, vol. ix. p. 596).

Tatars, or Tartars.—An uneducated Russian calls all Mussulmans by this name, which once inspired terror, but it now rather shows a want of consideration. An unexpected guest, says a Russian proverb, is worth less than a Tartar. They live now widely disseminated in Lithuania, on the Volga, in the Ural, Crimea, Caucasus, and Siberia, under the deep shadow of the Russian Eagle.

The Tartars, or Kiptchak Mongols, descendants of Thu-kin and Uigurs (Prichard), invaded Russia in the thirteenth century (1235), and thus consummated the union of the Empire of Monomachus. They maintained their dominion, manifested in exacting taxes, during one and a half centuries, and exercised a not inconsiderable influence on political, social, and moral life in Russia. According to the Russian historian Bestujew-Riunine, this influence manifested itself more particularly in the organisation of the army, the establishment of taxes *per capita*, and the destruction of every germ of self-government.

Russians have well revenged themselves for their short humiliation, and may well now treat their former conquerors with magnanimity.

Besides other peoples equally of Tartar origin, there are six or seven groups of Tartars proper, viz.:—(*a*) *Kazan-tatars*, dwelling on both banks of the Volga, below the Oka and on the lower Kama, penetrating also further south into the Riason, Tamboff, Samara, Simbirsk, and Panze governments. They number above one million, and are considered as

descendants from the Kiptchak of the Golden Horde and Bulgarians, who established here, before the arrival of the Tartars, the first historical monarchy of north-eastern Russia. On the ruins of this Bulgarian kingdom Ulu-Mahomet, commander of the Mongolian Tartars, founded the kingdom of Kazan, which subsisted until its conquest and destruction by the Tsar Ivan the Terrible, that is up to 1552.

The Kazan Tartars have a half-Bulgarian and half-Finnish or Ugrian type—high cheek-bones, square strong jaws, low and broad forehead, slightly oblique eyes, thin and lank hair.

A group of Tartars from the district of Bortchala.

(*b*) *Astrakhan Tatars*, dwelling in the province of this name, are subdivided into two distinct groups: *Yurtovskij* (living in yurts), descended from the Khazare and Turko-Mongols of the Golden Horde, and *Kundurovskij*, offspring of the conquerors who established their dominion in south-eastern Russia under the name of the Great Horde in the thirteenth century, and afterwards maintained it under the name of the kingdom of Astrakhan up to the eighteenth century, when the last khan of this horde fled to the Crimea.

(*c*) *Lithuanian Tatars*, dwelling on the Baltic shore in the Grodno, Minsk, and Vitebsk governments (White Russia), are also the remnants of the great Nogaï horde, who invaded this country in the fifteenth

century, but were soon driven back by Poles. They preserve the Moslem faith of their ancestors, but otherwise have adopted the language, dress, and to some extent the mode of life of the Lithuanian peasants.

(*d*) The *Tatars of the Crimea* are now a very small remnant of a once powerful kingdom which for long was a rival to Russia, and successfully repulsed the double invasion of the last power during the reign of Sophia, half-sister of Peter the Great, but finally lost its independence in 1783. The Crimea Tartars have during the last twenty years emigrated in great numbers to Turkey, and, like many Caucasian Mussulmans, are about to desert completely their ancient territory.

Besides these four groups of Tartars dwelling in Russia proper, there are Siberian and Altai Tartars in Siberia and Azerbaijan, Daghestan, Kumic, Karatchai, Kasikumic, Karapapakh, and other Tartars in Caucasus and Transcaucasia. In fact, it is a very arbitrary and elastic name, applied almost to all Russian Mussulmans, with the exception of Caucasian Highlanders, Turks, Persians, Kurds, and Kirghiz.

Azerbaijan Tatars, inhabiting the eastern half of Transcaucasia, are the most numerous body of Tartars—above one million (1,139,659): but we need not enter here into a further discussion of them, and may proceed at once to characterise Tartars in general.

All speak the Tartar language, similar to Turkish, and use for writing the Arabic alphabet.

The Tartar communities of Russia are far from being prosperous; they are mostly poor and unprogressive. With other drawbacks common to all subjects of the immense and strongly centralised empire, they suffer from moral isolation amidst their Christian neighbours, which they do little to break down, each party deeming itself vastly superior to the other, one calling itself True Worshippers (Orthodox) and the other True Believers.

Sons of the great conquerors, having possessed at one moment in their history the ambition to dominate the world, the Tartars remain conscious of their former glory; they have preserved something of personal dignity, but otherwise live mostly in the remembrance of the past without much activity in the present. They have mostly become quiet, industrious, peaceful and orderly subjects of the White Tsar. They stubbornly resist, however, Russification, they object to their children being sent to Russian schools, and they have no good schools of their own. They maintain their communion with the Mussulman world outside Russia, and readily submit to the influence of Mullah, Dervishes, and other religious men.

There are to be distinguished among Tartars different social classes having their special virtues and vices. The Russian Government has recognised the Tartar nobility, after proofs being given of their titles, and has conferred on it some of the privileges of the Russian nobles. There are khan, sultans, aga, beg, beys and other noblemen. Some of them go into the army, where they are not precluded from reaching high positions. But they mostly prefer the more quiet life of a landlord, or *Mulkadar*, giving their land for labour to peasants and being paid in return with 0·4 part of the harvest (*mulk*). It is a lazy and dull life,

divided among the delights of the harem, smoking narghileh, card-playing, and falconry; but it pleases these indolent natures, and many young noblemen, having obtained their epaulets in the military schools of Moscow, Tiflis, and Orenburg, do not attempt to resist on their first visit home their impulse to abandon all the glory of civilisation and a brilliant career for this very quiet and effaced life. It seems that this strange conduct is chiefly influenced by the women.

The most influential social class among Tartars are the clergy—mullah, muftis, and others. They are priests, teachers, and judges all at once. They are not rich, quite poor sometimes, but, in their fashion, they are a learned body of men, knowing and interpreting the Koran, saying prayers in Arabic, having learned how to read and to write, and to inspire admiration in their followers, and keeping in touch with all the ecclesiastical dignitaries of the Mussulman world. Next to the clergy come Dervishes and Mussulman monks, who by their stories and their life of sacrifice and renunciation contribute much to the maintenance of the religious fervour.

Next in consideration comes the class of merchants, tradesmen, and artisans. Tartar traders generally enjoy a character for honesty; they are shrewd enough, and with a Kazan Tartar especially it is necessary to haggle long and sharply before concluding a bargain; but they are well reputed even among their Christian neighbours. The Tartar merchants in the Caucasus are always dignified and respectable. The trade connections of Kazan, Tiflis, Bacus, and Astrakhan Tartars are not inconsiderable—there are even some millionaires among them.

Among Tartars there are many skilful artisans, and we have already had occasion to indicate here the important part they and their co-religionists take in the small trades (*S. G. M.*, vol. vii. p. 140). But it is the common Tartar people, husbandmen, shepherds, draymen, fishermen, labourers of every kind, that are the most worthy of attention. Tartars do not like confinement, and they prefer industrial exercise in the open air. They support the summer heat better than Russians do, and are consequently capable of ploughing land and raising flocks in the dry and hot steppes, where most Russians would succumb. Most of the Tartars remain semi-nomads: Azerbaijan and Siberian Tartars travel with their flocks according to the season; Crim Tartars are gardeners or draymen, and Kazan Tartars in considerable numbers perambulate over the whole extent of Russia with their morning-gowns and soap and other wares.

The personal appearance of a Tartar peasant or herdsman is not engaging: with his salient cheeks, rough guttural voice, and violent gestures, he is clumsy and uncouth. He wears in Caucasia a long gown and big fur cap; but he is an excellent horseman, and though childishly ignorant and superstitious he preserves a certain personal dignity, especially when he has the fortune to visit one of the sacred Mussulman places such as Kelbalay, Mecca, or Meshed.

We confess, however, that it is difficult to judge fairly the moral character of Tartars. The author has lived long among them and has got generally favourable impressions. They have certainly many vices:

they are not what we call civilised men; their homes lack almost every comfort; their villages are dirty beyond description; they are superstitious, ignorant, deceitful, indolent, violent, revengeful, passionate; they are lustful and inclined to some abject and unnatural vices; but with all that and something more, they have also some noble qualities. They fear God and respect their elders; they are sober, dignified, hospitable, intelligent, faithful, courageous, and generally honest. They are not a slave-born people, but a proud and self-respecting one. But where is the touchstone to judge of a people's morality? We have tried to get some statistics concerning the criminality among Tartars, but with no useful result. The Tartars are not more inclined to law-breaking than any other Russian subjects, and even should there be a greater percentage among them of those who are called to answer before the justices (which has not been demonstrated), it is necessary to remember that they are governed by foreign laws imposed on them. Perhaps they are as good citizens as other people on the same grade of civilisation. They direly want instruction in arts and science, but they are easier to deal with than many other Christian people on the confines of Russia—Poles or Armenians, for instance—for they have no national but only religious aspirations, and are exceedingly amenable to the influence of men of some prestige capable of inspiring in them truth and confidence.

There are some Tartar proverbs which may perhaps serve to complete this very summary and incomplete account of their moral character. "An unwilling horse has itself to blame if exhausted." "When there is no horse, saddle an ass." "A cow poor of milk lows the most." "Be thief or robber, but keep your word." "One cannot scratch without nails." "There is no place for two melons under the armpit." "First fasten your ass, and then confide it to Allah." "Before a just man, even mountains incline." "Deep waters are not muddy." "Be patient, if you expect happiness."

Tartars are eminently suited for military service from their courage and endurance; but as yet they do not inspire sufficient confidence in the Russian Government, and they object to being incorporated in the Russian body-troops. In consequence, the Tartars (in Caucasia at least) form bodies of militia, but are not subject to compulsory military service.

We will not enter here into the family life and position of women among Tartars—it has been sufficiently discussed; and we need only notice that Tartar women whilst young are generally cheerful, gentle, careless, and charming beings, and that the Tartar children, when taught, show an extraordinary precocity of intelligence.

Bashkirs.—Another distinct, though far less numerous, group of Russian Mussulmans constitute the Russian Turks under the names of Bashkir, Teptyars (Teptjaeras), Meshtcheriak, and Baraba. They number about one million (895,031), and are considered as appertaining to the Ural-Altaic family of Turks. They dwelt formerly on both slopes of the Ural mountains, but were driven from it by Ugrian or Finno-Hungarians in the ninth century, conquered by Kazan Tartars, and with them became later Russian subjects. They have been subjected to a poll-

tax, and allowed to occupy vast territories in the basins of the Kama and Bielaia. They did not submit at once, but revolted in 1735, during the reign of Anna, when they were subdued and severely punished. About thirty thousand of them were partly massacred and partly banished; their children were sold. Soon afterwards they were compelled to very severe military service, but revolted again (1773), and in the reign of Catharine II. they fought on the side of Pugatchev. Since 1810 they have been embodied in the irregular troops of "Ural Kasaks," and constitute now the bulk of this particular military colony. Since 1874 some of the Bashkirs have been transformed into a regular cavalry—a fact which illustrates the degree of their Russification; and, in fact, their Islam faith, which is far from being ardent, does not in the least prevent them from being peaceful husbandmen, shepherds, and agriculturists. They are Mongol Turks, and are thus not precisely beautiful with their small and broad heads, flattened features, snub noses, and small eyes. They are decidedly inferior to the Tartars in intellectual capacity.

In religious matters they are directed by about seventeen thousand *muftis*, under the Chief Mufti of Orenburg, and paid by the State, whose expenses under this head are estimated at £177,464.

We had no particular opportunities for studying Bashkirs, but it is otherwise with the following groups of Russian Mussulmans, recognised under the name of *Gortzy* (highlanders) or Caucasians.

Caucasians.—There is a striking difference between this and the preceding groups of Russian Mussulmans; they are the most fanatic, the most warlike, and at the same time the fairest adherents of Islam. In this case we see the great political importance of a creed, for surely they would never have offered such a stubborn and prolonged resistance to the Russians, had they not been Mussulmans. A great number of them, who had not fallen on the battlefield, fled to Turkey, and perished in their migration. They are diminishing in numbers—some tribes have already completely disappeared—and they count now, in the whole Caucasus, scarcely six hundred thousand souls, divided into thirty-five small tribes or nationalities. They are on the point of disappearing from the earth, and yet, curiously enough, the question of their origin, and whether they are the remnants of numerous ancient peoples or disintegrated fragments of but one or two great nations, is not solved. We give here the names of the principal tribes with their official numbers according to the two last censuses.

Caucasian Highlanders according to the census of

	1886-91	1896
Enghiloy,	8,935	8,727
Ajar,	59,258	59,495
Lazy,	98,244	96,920
Circassian and Kabardir,	3,762	1,384
Abkhasian,	59,728	29,792
Carry forward,	229,927	196,318

	1886-91	1896
Brought forward, .	229,927	196,318
Tchetchen, ...	940	3,413
Lesghian, ...	470	196
Avar, ...	156,610	159,936
Karatin, ...	7,054	7,217
Darghin, ...	107,328	107,168
Kasikumykh (Laki), . . .	47,971	48,316
Andian, ...	7,995	7,575
Dido, ...	4,703	4,844
Bogulal, ...	1,310	1,474
Akhvatok, ...	3,290	3,585
Botlikh, ...	1,310	1,383
Godobery, ...	940	887
Tchamalal, ...	4,320	3,889
Kurin, ...	149,085	41,849
Rutul, ...	11,758	11,985
Kaitag, ...	14,579	14,356
Tabassaron, ...	26,477	27,667
Aghul, ...	6,584	6,830
12 other small tribes, . . .	40,644	31,238
Total,	823,295	620,104

The most numerous of the Moslem highlanders are Avars, Kurin, and Darghin, dwelling in Daghestan, Ajars, and Lazy in the Batum and Artvin districts of the Kutaïs government.

We have no intention of entering here into particulars of the more or less glorious story of each of these tribes. Save language, there are no very great distinctions among them now. Their individual characteristics are wearing out under the monotonous uniformity imposed on them by the present uniform conditions of their peaceful and uneventful existence. All that we wish to do is to give some idea of the external life of this remarkable, richly-endowed, but unfortunate community.

They live widely dispersed in small villages or *aüls*, built in deep narrow gorges or on the verges of precipitous mountains, and consisting of crowded one-storied, flat-roofed, irregular and heavy stone buildings, called *saclu*. There is usually only one dark, narrow street in this village, often accessible only to horsemen or pedestrians; there is often a humble mosque with a high minaret and a larger public place in the shadow of it. The villages are few and far between; usually they emerge to the traveller quite unexpectedly from the dense mist that envelops them, and are announced by the violent barking of dogs. The aspect of these villages in a gloomy winter day is dull, sad, and mournful beyond description; there is nothing to break the dead silence save an occasional cock's crow, a horse's neighing, a dog's barking, and at appointed hours the long and plaintive cry of *Budune* or muezzin calling to prayer from the balcony of a minaret. Its aspect is far more lively on a fine summer day. Women are the first to stir; old and young they

proceed to their daywork with the dawn, the first go to the field, or remain to take care of their household, the second, attired in gaudy colours, with high copper pitchers on their shoulders, proceed solemnly to the river to fetch water, and to exchange their impressions. Nor do the men tarry long in their gloomy *sacla*; they make their ablutions, and gather in the court of the mosque to learn the news, or to listen to any wonderful story-teller. They are tall and slender men, grave, silent, stern, and apparently apathetic; but there is fire and subdued passion in their small, sparkling eyes, their look is intelligent, and they would

A Tcherkey in ambuscade.

certainly act if they only knew what there is to be done. They take interest in all, but they are uneducated and profoundly ignorant; they had no leisure while engaged in war, and now, the war over, they have not learned how to employ their energy. Politics assume with them a curious aspect. Gambetta is known to them, for instance, under the name of Khan Betta, as a courageous, single-eyed vizir of the French padishah, who baffled hundreds of thousands of his enemies by ascending to the sky in a balloon.

They form a strange, rather childish world, at once reserved and demonstrative. They are reserved and apathetic in their usual daily life, demonstrative on extraordinary occasions: receptions of chiefs, of

pilgrims, or of liberated convicts, bidding farewell to convicts whom they venerate as heroes. There is then much shooting, shouting, wild running and racing, and all kinds of noisy demonstrations.

We speak of greeting and honouring noteworthy criminals. There is not complete agreement in morals between the national conscience and the criminal law as laid down by Russian tribunals. To seek revenge for the offence done, to draw one's dagger in case of provocation, are, for instance, acts approved, and even commended, by the national conscience, but they are reproved and punished by Russian criminal law. "Allah," says the mountaineer, "has given me the heart, and my father has left me a dagger to defend my honour when wounded; no judge can ever wash off an offence done to me or my kinsfolk." These are the views transmitted to him by numerous generations, which have entered into his very blood and substance, but, of course, the Russian law cannot admit this kind of reasoning, hence a tragic conflict, which only time and education can appease. But they are an honest people for all that: they disapprove petty crimes, such as theft, pillage, and cheating; they are friendly and hospitable, and one may travel among them with almost perfect security.

One of the curious features of most Caucasian highlanders is the habit of idle questioning when meeting a friend after a period of absence. "How are you? how are your goods? how are your liberty, your vexations, your diseases, your misfortunes, your sorrows, your joys, your kinsmen? How are those who enjoy your confidence, those who love you, and those that are dear to you?" etc. etc. These are questions deliberately made by one party, whilst the other party quite as deliberately repeats the same questions after an invariable answer to each of them, whatever may be the real state of things: "Glory to Allah, all is well." There is not a syllable of confidence in all this idle questioning, it is purely a matter of formal politeness.

The people are highly conservative; the ancient customs are adhered to with great tenacity. This inclination to respect tradition generally ensures peace and harmony in the family and social life; the young respect the old, women respect men.

The domains of influence, authority, and activity of each party are firmly and invariably determined. Man has certainly the best of it; to him belongs the supremacy, he has all privileges; he takes care of his horse, his cattle, he has to provide fuel, he may have some particular industry, but it is on his wife that he abandons not only all care for the house and children, but also field work, and indeed every work she may be able to perform. The poor woman has certainly much to support at the hands of these rough, impulsive men, but she has also her own weapons, she knows how to compel even the strongest man to do her will, and she has usually a strong temper, and much courage, energy, and endurance. She marries often whom she loves on account of the indomitable nature of her passions.

The Caucasian highlanders are now experiencing a period of a profound social and economical crisis. They have to adapt themselves to new conditions of life or perish. They are diminishing in number, but

happily hope is not yet entirely excluded. Schools are gradually being introduced among them, and we hear that according to the recent official statistics about ten thousand Mussulman pupils, of whom thirty-four per cent. are girls, are being educated in Russian schools. New arts and more knowledge are slowly finding their way among this brave people, whose energies require a new field of activity after a deadly and now long past struggle for independence.

They have splendid qualities. Their extraordinary sobriety, simplicity of manners, sense of dignity, courage, and hospitality, their strong religious feeling and their easy submission to the decrees of Allah, render them worthy of sympathy and interest on the part of the statesmen, in whose hands are now placed their destinies. They are certainly fitted for a higher civilisation than that which they now possess. They will not be, nor need they be, Russians, but they may constitute a useful element in the progress of the great empire. The Tsar already obtains his life-guards from among these faithful men, and these privileged subjects returning home invested with some authority are naturally considered as useful intermediaries between their compatriots and their new masters.

Kurds.—There are other Mussulmans in Caucasia besides Tartars and highlanders, viz.:—Tat, Talyshin, Persians, and especially Kurds. The last number above one hundred thousand, of whom fifty-five per cent. are men and forty-five per cent women. They are a peculiar kind of people, not quite unjustly called pastoral robbers. They are far less amenable to a higher civilisation than Tartars or highlanders, who are mostly a settled people, while they are inveterate nomads, seeming to be really incapable of supporting confined air and regular occupations. A Tartar proverb says, "No shepherds among wolves, no saint among Kurds."

This group of Russian Mussulmans, with whom the readers of this magazine have already some acquaintance, thanks to the paper of Mr. Eghiasaroff, himself a Kurd (vol. viii.), is perhaps the most difficult to deal with. Robbery with them is rather a virtue than a crime. Intolerant of foreign authority, impressionable, violent, and childishly ignorant and superstitious, they occupy with their numerous flocks the vast, partly deserted, not easily accessible territory on the slopes of Ararat, Agri-Dagh, and Alaghës, on the ill-determined frontiers between Russia, Turkey, and Persia.

And yet, notwithstanding their bad reputation, they are a splendid example of humanity, at least in the eyes of those who are not convinced that a London dandy or a Parisian boulevardier are true masterpieces of the best nature has ever produced. The Kurd has little in common with them, it is true, but he has his own virtues which are worthy of all admiration. Tall, robust, broad-chested, keen-eyed, sharp-eared, daring, quick, and intelligent, excellent horseman and shot, he is not made to confine himself in a city or workshop, he wants space, mountains and extensive grazing-ground, and he can live happily only in the vast expanse of unspoiled nature.

The author has had some personal friends among the Kurds; he has

enjoyed their simple, but large and hearty hospitality, he has assisted at their warlike sport, and has seen them showing their prowess on horseback armed with long pikes, and he cannot entirely refuse his admiration for their manly and noble qualities. They live in tents during the whole year, changing their encampments according to the season. They are thus to such a degree accustomed to the open air, that even in winter they cannot tolerate being shut up in a room for a long time.

This requirement for more and more room for their tents and their flocks constitutes the first great difficulty in dealing with the tribe on the part of the government. They are always complaining of not having space enough; and not being allowed to occupy all the space they want, they encroach on that of their neighbours. The second difficulty in dealing with them is principally in their not being friendly with their neighbours. They have an unmistakable hatred of Armenians. There is a sharp contrast between these two nationalities. The Armenians are a worthy, wise, intelligent, cautious, and discreet people, mostly skilful, wily, unscrupulous, active, and experienced in trade and usury, knowing their world, versed in law, knowing many languages, able to get money with every appearance of legality. Kurds are simple-minded, childish, unlettered, ignorant, impressionable, artless, over-confident, improvident, impulsive.

It is easy to see which is likely to be the victim in the struggle for existence between these two communities so unlike in character.

At the hands of his astute Christian brother, who knows how to make himself indispensable, the simple Kurd is dupe in selling and in buying alike; he gets blindly into the snare, like a Russian peasant at the hands of a Jew, and he can only curse his eternal enemy, or, occasionally exasperated, draw out his dagger against him. The cunning of Armenians is proverbial, he has all the trumps in his hand, and he succeeds sometimes in devices almost incredible. We have been told, for instance (the story has been reported in an official publication), of a case of a murder where an innocent Kurd by the name of Khro was substituted and sentenced in the place of an Armenian by the name of Kro, only because he could never explain to his judges, and an Armenian interpreter would never help him in his task, that he was not Kro the murderer, but Khro an innocent man.

It is just to mention in defence of Armenians that they are now, under the protection of Russian laws, taking revenge of the Kurds, their old enemies, who always despised them and have considered it just not only to eat their bread, but also let them pay for the wear and tear of their teeth.

Kirghiz-Kazans and Kara-Kirghiz or Buriat.—The last large group of Russian Mussulmans we have to mention inhabits a vast tract of a dismal, monotonous, sterile, stony, and streamless country, situated in Eastern Russia, in the provinces of Orenburg, Uralsk, and Semipalatinsk. They have been recently made the subject of an interesting study of Professor Brocherel in this magazine, and we have therefore only a few things to add.

We may notice first that Professor Brocherel's statement that the

Kirghiz have never been the object of any careful study, is not wholly accurate. Under the auspices of the Russian Government, General N. Grodenoff undertook about twelve years ago a careful study of the Kirghiz, the results of which have been embodied in two big volumes in Russian. They have been partly translated by the author of the present paper in a series of articles published in the French journal *Revue générale du droit*, and here also appeared as a reprint with a long introduction published by Ernest Thorin, Paris, 1891. The life and manners of the Kirghiz have been studied besides by other ethnographers, Levchin, Meyer, Krassovsky, Tillo, Kostenko, Khorochkin, Grebenkin, Kharasin, and others. See also vol. vi. p. 150 of this magazine. We may mention also Dr. Prichard, who has studied the Kirghiz, and whose statements about their physique disagree with those of Professor Brocherel, as the last declares them to be "well built and very strong," while the first has found them "rather devoid of muscular strength."

The official number of the Kirghiz, according to the census of 1899, is about four millions (3,637,394), but we readily agree with M. Brocherel that those estimates do not command perfect confidence.

Much may be speculated in regard to the origin of this very peculiar, nomad, pastoral, quiet, unprogressive people. To the other numerous speculations on the subject may be added that recently hazarded by Professor Diffloth, according to which they are the descendants of Hakkas, who were overthrown in 848 by the Hoci-he, a confederation of Turkish tribes in the north of China (*Revue Scient.*, vol. xvi. p. 271). We will say nothing either about the well-known personal appearance of the Kirghiz, nor their peculiar diet, nor their divisions, nor their enmities.

We would only like to say here some words about their horses, which are indispensable to them, as they live principally on mare's milk. This horse is small (about 4.65 feet), but enduring and robust. It is usually light-coloured and often dun, flea-bitten gray, or roan; it has a well-proportioned head, expressive large eyes and active ears. Its neck is slightly inverted, withers raised, spine straight, croup fallen in, the limbs dry and well-developed. There is no great beauty in its form, for it is less beautiful by far than the Arab, but it is very strong and hardy.

The Kirghiz horses live all the year round on pastures under open skies; they are socially organised in *kossiaks*—a community of about fifteen mares, led and protected by a stallion. A certain number of *kossiaks* constitute a *tabun*. Colts and geldings graze apart. The poor horses suffer much from heat and lack of water in summer, and from cold and snow in winter: they are left to provide for themselves, and very naturally they often fall victims to epidemics. Kirghiz are fond of races, and they encourage them by instituting a prize of 400 sheep or a precious weapon for the person who arrives first running a distance of 33 to 40 miles. The girls ride about as well as the men. A Kirghiz runs after his beloved much in the same manner as drones pursue a virgin queen in a bee-hive. On the appointed date marriageable girls (about seventeen years old) gather in the steppe mounted on the best stallions of their fathers. They are followed by their suitors equally mounted.

Suddenly one of the girls gallops off, she is pursued by her suitors and becomes the legitimate prize of the one who succeeds in passing and seizing her.

This strange custom shows better than anything else at what a very low stage of culture these tribes stand. They have not made the least progress during the thousand, perhaps many thousand, years of their existence. They have been converted to Islam, but the Koran has remained unknown to them, and has no power to influence in any way their uneventful, monotonous existence, limited to the satisfaction of their very few and primitive wants.

Conclusion.—Now what conclusion may we derive from this very cursory description of the five principal groups of Russian Mussulmans? We have seen that they are composed of different races and are differently endowed. But they all occupy in Russia an inferior situation, and seem to be a rather neglected part of the Russian population. They are unprogressive, and they remain very poor and ignorant. Their state of mind is that of a gloomy and passive resignation. Has their Moslem creed something to do with this? In one sense, certainly, yes, but in this sense only. It estranges them from the rest of the population, it isolates them morally; their evolution is arrested by their persistent ignoring of the new conditions of existence, created for them by their incorporation into a vast Christian empire. But Islam by itself is not unprogressive, it does not constitute by itself any serious obstacle to the economical and intellectual advance of the Mussulman portion of the Russian population. An eminent French statesman has said recently:—"Le respect des croyances n'est nullement incompatible avec la grandeur de l'état et le progrès des libres institutions" (Goblet). We believe that Islam is quite as respectable as any other religious creed, and that by paying a due respect to it, and not only disdainfully tolerating it, a powerful Christian state, such as Russia, or England, may not only contribute to the progress and well-being of that portion of their population which adheres to the Koran, but profit also in return from the special virtues of their Mussulman subjects, and thus further the progress of the community as a whole. Islam teaches many good things, and combats many ideas which are at the root of present political and economical troubles on the continent of Europe. Its leading principles are in favour of authority, the necessity of submission to God's decree, the solidarity of all men, the preference for a quiet, contemplative life as against the restless pursuit of purely material goods.

If there should ever arise a closer friendship, or at least less estrangement, between Christians and Mussulmans, the consequences would be equally beneficial to both parties.

Among other difficulties the Russian Government has to contend with in its relations to its Mussulman subjects the most noteworthy are perhaps those relating to the administration of justice. The Mussulman objects to many points of Russian civil and criminal law, his conscience is not satisfied by the sentences of Russian tribunals, composed of Christian judges usually ignorant of the language and the mental condi-

tion of the accused, and he shows his disrespect for this tribunal by cheating it in every possible way. We cannot here enter into the consideration of the means and ways of the necessary reconciliation of the followers of Islam with Christian courts of justice; it is not at all a geographical subject, but we do not despair of the solution, and we remain assured that in Islam there is no more obstacle to progress than in any other creed, and that fairly and generously treated the Russian Mussulmans, like those of other civilised states, are quite capable of attaining a higher development, to the benefit of all mankind.

HUMUS AS A GEOGRAPHICAL AGENCY.

By Marcel Hardy, University College, Dundee.

The excellent translation by M. Ed. Henry [1] of E. Wollny's book on the decomposition of organic matter and kinds of soils, has again drawn attention to this fundamental work. E. Wollny greatly added to, arranged methodically, and criticised the researches on this subject which were scattered throughout scientific publications; and from these he draws conclusions which are of interest to the botanist, the agriculturalist, and the forester, no less than to the geographer. Thus it is necessary to give a concise account of this important work, not only in order to direct the attention of specialists to the original, but also to give the general public a grasp of the whole question, that they may utilise practically the results.

Organic remains lie either on the surface of the ground or in its more superficial layers, where they are continually undergoing physical and chemical changes, which vary with the nature and state of the material and with the external conditions. From a chemical standpoint these processes may be reduced to two main types: oxidation, when there is a sufficient supply of air to the organic matter, and reduction when otherwise. Slow oxidation or eremacausis is chiefly characterised by a somewhat abundant formation of volatile products, such as carbon dioxide, ammonia, water, leaving a residue of mineral matter, most of which is available for immediate use to the higher plants.

On the other hand, if oxygen is not supplied to the decaying matter in sufficient amount, the mode of decomposition becomes a process of reduction or putrefaction. The gaseous products are then much less abundant. They are principally carbon dioxide, marsh-gas, hydrogen, sulphuretted hydrogen, and some others. The solid residue is consequently greater, mainly consisting of nitrogenous compounds, volatile fatty acids, and mineral matter, and is unfit for immediate use by the higher plants. It is dark in colour and very resistant to any further decomposition changes. In both cases, however, these phenomena are

[1] E. Wollny, *La décomposition des matières organiques et les formes d'humus dans leurs rapports avec l'agriculture.* Traduction E. Henry. 1902.

chiefly of a biological nature, and due mainly either to the micro-organisms which air, water, and soil contain in varying amount, or to soluble ferments. Most of these micro-organisms are lower plants, such as bacteria, Mucorineae, and, to a less extent, yeast. The Mucorineae have a considerable oxidising power, whereas a great many bacteria, by nature or circumstances anaerobic, act as reducing agents. In putrefaction, for instance, these bacteria bring about the first stages of reduction. All these organisms live exclusively in the superficial layers of the soil, though protected from the light. At a depth of one metre their numbers have greatly decreased; at two metres they have practically disappeared.

Quite a number of animals contribute to the eremacausis process of decomposition. These are rhizopods, earth-worms, Anguillulae, crustaceae, snails and slugs, myriapods, many insects, both larval and adult. They work by tearing up the material, or swallowing and digesting it.[1]

Various agencies are at work, modifying both the rate at which the transformation proceeds and its nature. On the one hand, the physical and chemical conditions of the matter itself; and on the other, the external conditions—air, heat, moisture, light, and chemical agencies.

Thus, the general process of decomposition is the outcome of a number of simultaneous minor processes. Apart from purely chemical forces, each of these is controlled by the activity of certain micro-organisms and soluble ferments, this activity being in its turn controlled by the combination of the conditions of the matter and of external circumstances. The decomposition thus varies its aspects according to the prevalence of one or another process. But, as a rule, the whole is controlled in quantity and quality by the factor which is at a maximum or at a minimum.

In nature these factors at once depend upon the climate and the soil with its living and dead plant covering. We may thus approach the problem from this standpoint and investigate the influence of each component of the climate, soil, and vegetable carpet upon each of the main processes, especially on the freeing of carbon dioxide, which may be used as a criterion of the intensity of decomposition. We are thus enabled to formulate certain general conclusions, based upon the law of maximum and minimum, which we have already mentioned.

Among the different factors of climate we must above all consider temperature and moisture.[2] When we remember that lowering of temperature is associated with a decrease of biological and chemical activities, we easily understand why decomposition must be slower, and hence accumulation of organic residues faster, in the north than in the south,

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[1] Keller, C., *Humusbildung und Bodencultur unter dem einflusstierischer Thätigkeit.* 1887.

[2] Researches made by a number of scientific workers have shown beyond doubt that light, especially its blue and violet rays, has an injurious influence on bacteria. It is to be hoped that methodical observations and experiments will bring into greater prominence the consequences of this fact, which are, in all probability, of importance in the decomposition of organic matter in nature.

in the highlands than in the lowlands. Where moisture is relatively constant, it is the temperature which controls the decomposition, as in the Lombardo-Venetian plain. Conversely, when temperature is moderate and constant, moisture becomes the predominant agency, as in Sicily and Southern Italy.

The influence of the soil varies with its position, slope, and physical and chemical constitution. In the dry season, or in a dry country, for instance, a northern exposure will offer the more favourable conditions for decomposition. Among the mountains of the south of France the soil is deeper on the northern slopes, because there the moisture necessary for eremacausis is more abundant and remains longer than on the southern slopes, showing that the greater moisture more than compensates for the lower temperature. With these conditions reversed, a southern exposure will produce the greater intensity of eremacausis. As regards the slope of the ground, when there is an average inclination of 20°, the production of carbon dioxide is at a maximum. It decreases when the slope is steeper or more gentle.

The physical constitution of the soil will determine its heat and the quantity of air and water which it holds. Hence its effects are very complicated. As the amount of water increases, there is a corresponding decrease in the permeability to air. The finer the grain of the soil the less the permeability to water. Soils which are rich in colloidal substances—humus, clay, and iron—are impermeable to air even when they contain an amount of water still far from saturation. On the other hand, the amount of water influences conduction and calorific capacity. For example, during the cold season, a peaty soil is the warmest, then loam, limestone, and lastly sand. In spring these temperature relations are altered, so that in summer the sand is warmest, then peaty soil, limestone, and loam. Thus, if we are considering the warm period only, the thermal characters of clay or loam are the least favourable for decomposition, those of sand the most favourable. Hence it will be seen why practical men call clayey grounds cold and sandy soils warm.

The chemical nature of the soil may be of great importance. For example, lime, as carbonate, furthers the formation of humic acids; as sulphate, it favours nitrification.

The carpet of living plants and the decaying deposits are at work hastening or abating the above-mentioned influences. A living covering retards the decomposition of organic matter just in proportion to the vigour and density of the plants composing it, while in a soil coated with dead material the eremacausis is slower than in bare earth, but more rapid than in ground clothed with growing plants. The result of the decomposition of organic matter is thus the production of a number of elementary volatile substances with a solid organic residue containing also mineral salts. It is to this organic residue that the name humus applies.

Wherever a moderate amount of moisture, and a fairly high temperature, along with enough air produce a strong eremacausis, humus is only formed in trifling quantity. When one of the factors falls to

minimum, the gasification of the organic matter correspondingly decreases, balanced by an increase of solid residues. Climate and soil thus both have their influence upon the production of humus. Humus is comparatively thin in a moist and moderate climate, as in the greater part of France where peat-bogs are rare, occurring only in the mountains. In tropical regions, where the insolation is continuous, fermentation may proceed so rapidly that practically no humus residue is left. With the lowering of temperature at higher latitudes or altitudes, the thickness of organic residues increases as we see in the zone of lowland peat-bogs or morasses of Ireland, Holland, Hanover, North Germany, and Russia, or in the mountain peat-bogs.

Similarly, the greater the permeability of the ground, the less can humus accumulate upon it. In fine-grained soils there is not enough air, under normal conditions, for an active eremacausis; consequently the organic matter is but slowly decomposed, leaving an abundant residue.

In some cases, the air-supply may be so meagre that the disintegration is a process of putrefaction, and humus gathers forming thick layers. According to the permeability of the soil, there is every link between these extremes, and the transitions are represented by very various types on account of the number of the agencies which are brought to bear upon the eremacausis.

Humus varies in colour from a dark brown to reddish yellow, according to its mode of formation. It presents widely different textures, porous in mould, spongy or friable in peat, earthy or fibrous elsewhere. Old peat has a greasy appearance, and forms an amorphous plastic moss. Humus consists of organic substances with a greater or less amount of mineral matter. Among the former are ulmin and ulmic acid, humin and humic acid, crenic and apocrenic acids, which arise from subsequent oxidation of humin and its acid. A comparative analysis of living and humic matter shows in the latter an increase of carbon and a corresponding decrease of hydrogen and oxygen. The nitrogen varies from 3 to 20 per cent. of the total humus weight, but is usually combined as insoluble compounds.

Humus forms an almost waterproof layer; but it absorbs the water easily and retains it even better than clay. On the other hand, it is subject to a very great evaporation. On the whole, humus contains more water than any other kind of soil, but gives it off to the plants with greater difficulty. It must therefore contain a greater proportion of water than sand or clay does, in order to meet the requirements of its vegetation.

Humus dried up in air becomes more permeable to gases. When water increases and the volume of the pores decreases, the quantity of carbonic, ammoniacal, and other gases, which is here always greater than in the open air, diminishes correspondingly. The humic substratums are very hygroscopic and remarkable by their power of condensing ammonia, marsh gas, sulphuretted hydrogen, etc.

On account of its dark colour, humus has a strong absorbing power for the sun's rays. On the other hand, it has but weak radiation. One

might then naturally expect to find it warming rapidly. But this is not the case, for the specific heat of this soil is greater than that of sand or clay. Moreover, an intense evaporation from the usually moist surface, prevents any considerable rise in temperature near the surface. The heat proceeds slowly downwards on account of the poor calorific conductivity of the material. All these properties explain how, with normal temperature variations, humus is on the average colder than sand in summer and warmer in winter.

Classification of Humus.—According to the external circumstances which control the production of humus, it may be classified into more or less well-defined groups.

Eremacausis products.—Humuses formed in favourable conditions of air, moisture, and temperature have this in common, that they disappear more or less quickly, forming carbon dioxide, water and ammonia, leaving a solid residue of the mineral constituents contained in organic matter, and that they give an alkaline or neutral reaction. This soil is generally termed mould (*Mull or Terreau*).

Agricultural mould is made from harvest remains and organic material brought to the land. It decomposes quickly and does not gather.

Forest mould includes the humus of the ground (*Waldmull*) and the humus of the covering (*Streumull*) or leaf mould. The former comes from the roots of trees that die in the earth every year. The latter is spread over the soil as a thin covering which decomposes rapidly. It is overlaid by a shallow, unstable layer of detritus. This humus is composed of an intimate mixture of organic constituents with the mineral elements of the soil.

Slime-mould (*Schlamm mull*) is formed in well oxygenated water. Should bad conditions be offered, the reaction grows less active and turns to putrefaction. This forms *rohhumus* or raw humus, which gathers in thick, compact layers.

Steppe raw humus is mainly due to the physical nature of the soil which prevents free access of air. It is formed in various climates, in very fine grained, little permeable soil which interferes with the water-supply to the deep roots and determines the exclusion of the forest and the predominating of the steppes, prairies, and similar herbaceous formations.

Heather raw humus results from lack of moisture in the regions where the dominating heather produces a dense felting or network of roots. It is often characterised by the formation, at no great depth, of a brown or black grit or pan, of organic origin, usually called Ortstein in German, Alios in French, and Moorpan in English.[1] This dark humus, of compact structure, is as tough as peat.

Forest raw humus[2] is derived from the material of the covering (*Streumull*), when, either on account of the temperature or the growth of

[1] Muller, P.E., *Studien über die Natürlichen Humusformen und deren Einwirkung auf Vegetation und Boden.* Berlin, 1887.

[2] Grebe, C., *Aufforstung von Ödlandereien.* 1896.

the trees, moisture decreases and air no longer is supplied in sufficient amount. Decomposition is retarded; the covering becomes more and more impermeable. The plants which settle on that humus, heaths and vacciniums, help by the compact network of their roots and their own remains to increase the deposit and exhaust the superficial layers of the ground.

Meadow or Pasture raw humus originates, on the contrary, from the decomposition of roots of grasses and other meadow herbs, with a limited supply of air and an excess of moisture. It is formed especially in the meadows or pastures, in the lowlying parts of the land.

Products of putrefaction.—The result of decomposition without oxygen is peat or acid humus, a very stable mass which may accumulate in vast beds. They are divided into lower or infra aquatic marsh or peat, and sphagnum- or supra-aquatic moors.

Lower or infra-aquatic marshes are formed in the neighbourhood of running water or in lake hollows, on physically and chemically very different soils. They arise from the putrefaction of grasses, sedges, and rushes, and a few mosses which grow on the quiet river banks and lake shores usually covered with alluvial deposits. When they thus invade ponds and lakes, they restrict the surface area.

The first condition for the occurrence of the plants of these marshes is a soil rich in nutritive elements, especially lime.

Sphagnum moors or supra-aquatic moors (*Haide moors*) are formed in hollows both in the plains and the mountains by the putrid decomposition of sphagnum mosses which grow at the surface of the water. They are constantly associated with very pure waters, especially poor in lime. They arise on very different subsoils, but more particularly on impermeable clay, peaty pastures, or on infra-aquatic marshes, if the nature of the water happens to change. These sphagnum moors often form in the forests on mountain slopes or plateaux, owing to the thick layers of raw humus which accumulate there, and the moorpan which it produces.[1]

Between these two types there is every stage of transition; they may even be intermixed.

Influence of Humus on the Fertility of the Soils.—Humus exerts a different influence according to whether it forms part of the soil itself or is spread over it as a covering. As a constituent of the soil, its effect on the vegetation varies with the amount contained in the soil. A moderate proportion of humus is a considerable help to the fertility, but an excess of humus is extremely unfavourable. Humus matter enriches the soil by contributing soluble foodstuffs, and protects it against percolating water which would otherwise dissolve and wash away its salts. From the researches of Petermann, P. P. Dehérain, Lawes, Gilbert, and Breal, we may conclude that higher plants can utilise some organic matters supplied to them, but it has not yet been ascertained whether those substances can be directly absorbed or whether they have to undergo a chemical change brought about by the action of certain substances

[1] Græbner, P., *Die Heide Norddeutschlands.* Leipzig, 1901.

secreted by the roots. Besides, quite a number of plants have symbiotic fungi or mycorhiza in their roots, which can supply to their hosts carbon and nitrogen from the organic detritus.

The formation of carbon dioxide in humus furthers the desintegration of the underlying rock and the solution of certain otherwise insoluble mineral constituents, and thus helps to increase the fertility of the soil. Humus has also the power of loosening compact soils, thus making them permeable; whereas with sand, it diminishes permeability. Consequently evaporation is furthered in sand, but checked in clays and compact subsoils. Finally humus moderates extremes of soil temperature arising from variations in external conditions.

The quality and quantity of the dead covering spread over the ground in forests depends upon many factors, but chiefly upon the nature and the condition of the materials composing it.[1] Organic matter amounts to 80 per cent. of the total weight of the covering, dried in open air. Of that mass, the greater part is made up of non-nitrogenous compounds. This humic covering or leaf mould absorbs a certain amount of water, which is proportionate to its thickness, but becomes more nearly constant as the thickness increases. Another portion of the fallen water percolates into the subsoil. This is greatest with a layer, twenty centimetres deep, of leaf mould. Evaporation is lessened in this layer, till, after a certain thickness, it remains constant. Upon the temperature of the soil, the dead covering also exerts a moderating influence, in that it does not undergo so wide a thermal variation range as does inorganic earth.

In all these ways the materials of the covering and the humus which arises from it constitute the natural manure of forest soil.

However, this influence of the covering on the physical and chemical constitution of deeper layers of the soil may become injurious, if the detritus decomposes in unfavourable conditions.

In a mould soil, there is first a superficial layer,[2] the most decomposed and exhausted by drainage; then a zone rich in soluble foodstuffs, and yet deeper, the crude earth, very little, if at all, modified. But where there is acid humic decomposition, the dissolving and washing away of the salts is of much greater import. Often there arises, thus, at no great depth, in the layer of active decomposition, a hard stratum of agglutinated humic substances which had first been dissolved and then reprecipitated. This organic grit or pan (*Ortstein-Alios*) constitutes an impermeable layer which offers a mechanical obstacle to the penetration of roots, water, or air into the soil beneath it, and becomes very injurious to the vegetation and healthiness of the country. Before a good many wells and pits had been dug through the pans of the landes of Gascony, this region, now one of the healthiest of France, was noted for its barrenness and unhealthiness.

From the foregoing, we see that humus deserves to rank among the

[1] Ramann, E., *Die Waldstreu und ihrer Bedeutung für Boden und Wald*. Berlin, 1890.

[2] Ramann, E., *Der Ortstein und ähnliche Secundärbildungen in den Alluvial- und Diluvialsanden*. Berlin, 1886.

agencies which determine the aspect and the future of a country, *i.e.* among the geographical agencies. Owing to its *rôle* having been overlooked, or not fully appreciated, many phenomena failed to find their correct interpretation.

In modifying the physical and chemical constitution of the soil, it affects the superficial erosion of the rocks. Here, by soluble acids, it furthers the disintegration of the solid rock, and impoverishes the superficial layers. Elsewhere by covering the soil, it protects it from extreme, variations of temperature and moisture; prevents the transportation of disintegration products, and checks erosion. In those light soils where it accumulates in proper quantities, it binds together and acts against a too rapid mechanical washing away.

Humus forms enormous deposits, particularly in peat-bogs, in tundras, and in steppes (*Tchernozom*). The coal-beds, too, we may in most cases conceive as derived from former infra-aquatic marshes of geological ages.

No less striking and varied is its action on vegetation. For instance, it changes a forest into a sphagnum bog or a heather tract, and again the bog into heather. It transforms pasture into marsh, marsh into infra-aquatic bog, this into sphagnum moor, etc. Elsewhere it develops slowly forest at the expense of steppe.

The geographer must take humus into account and understand its influence if he desires to interpret aright the relief and nature of the land, its vegetation and fauna, the economic and social history of man.

ANCIENT FIFE: SEEN THROUGH ITS PLACE-NAMES.

By L. Macbean.

Largo, a place famed in Scottish song and history, has recently had its existence doubted, because its name sounds unreal to the trained ear of a London journalist. Yet the word is not very outlandish. Although of Celtic origin, it has a near cousin in our English word "large," and in the musical term "largo." The old Celtic form is "learg," meaning a great hill slope, and in this sense it was applied to Largo Law, the hill of great slopes, anciently written Largauch, and it also gave name to Lairg in Ross-shire and Largs in Ayrshire.

Language of Place-Names.

It must be admitted, however, that the place-names of Fife and Kinross, the heart of ancient Pictland, have really many peculiarities of form when compared with those of southern or northern Scotland, or of England, Wales, or Ireland. No doubt there are many of these names containing roots common to Fife, Ireland, and the Highlands, the most frequent being Bal, a town, a word that has a distant relationship to

our "building": Kin, a head, like our word begin; Ard, high or height, the Latin *arduus*; Knock, a hill, like the English word neck; Loch, a lake; Inver, an inflowing, like the word "inference"; Kil or Kell, a wood; and the better-known words Craig, a rock; Ben, a hill or mountain; Glen, a valley, and Strath, a broad valley, all now adopted into English. Then we have in Fife a great many place-names beginning with Car (or Kir), a fortified town, which is also common to Ireland and Wales; and others beginning with Aber, *i.e.* a flowing to, an "afferent," which is common to Wales and Fife. But there are also some forms, such as "Pit" and "Auchter," as in Pitlessie and Auchtertool, which are almost peculiar to Fife itself. Pit (making allowance for the interchange of P and C) corresponds to the Gaelic *cuid*, Latin *quota*, and means a portion. Auchter, like the Gaelic *uachdair*, is probably a summit. These and other signs indicate that the language of old Fife, though a dialect of Gaelic, contained many old British words and forms.

Scenery of Ancient Fife.

If we study a large map of Fife, our attention is first caught by the enormous mass of names descriptive of scenery. The ancient Picts lived nearer to nature than we do, and spoke of natural features in a simple, childlike, graphic way, with the result that the natural features of old Fife stand out very distinctly in the place-names which they gave. The names are indeed not only Pictish but pictorial.

But it is a strange picture of the familiar county that they present, vastly different from the present aspect of this somewhat bare, dry, and bracing peninsula. The place-names disclose to us a country of numerous broad sheets of water, great stretches of impassable bogs and marshes, dense forests, and dark recesses, seldom trodden by the foot of man—the heritage of wolf and wild boar, and the abode of unknown forms of fear.

Waters.—The place-names derived from water are very numerous. Loch, the well-known word for a lake, not only marks existing lakes, such as Lochleven, Lochgelly, and others, but like a homeless ghost haunts the sites of vanished waters. Lochore and Lochty have long since disappeared, but their names hover round the districts where of yore their broad bosoms mirrored the sky. Lochty is marked as an extensive lake on the map of Fife published by Blaeu in 1654, but all of it that now remains is the Lochty Burn. The same map shows in the north-west of Fife, between Ladybank and Auchtermuchty, the wide rolling waters of Loch Rossie, now completely drained away. Sometimes the word "loch" is rather oddly disguised in the names, as in Camilla, *i.e.* Ceann-a-loch, the head of the loch, and Cullaloe, the back of the loch. On the north side of the Eden, near its mouth, lies a place bearing the curious name of Candleloch, where there is now neither loch nor candle. It is properly Ceann-da-loch, the head of two lochs, and Blaeu's map shows that near the spot lay two ancient lakes. Dour, the Pictish word for water, we have in the Dour Burn at Aberdour, in

Dura Den near Cupar, and Durie, a place between two streams near Leven. Another old Fife word for water is Orr, said to be cognate with Urr in the Basque tongue, and therefore one of the few survivals of the aboriginal Silurian tribe who inhabited Fife before the advent of the Celt. This word is found in Rankeillour, "the land of the wood by the water," and more purely in the former loch, and existing river, Orr. The district of the Ore gave its Latin name to the tribe found in Fife by the Romans—the Horestii. From the same water Ptolemy in the second century named the whole of Southern Fife "Orrea." The multitudinous waters of Fife used up almost all names for water found in a language which is naturally rich in such words. Linn, a pool, appears in Lundin and in Lindores; Tuil, a flood, is preserved in that not very majestic river the Tiel, and in Auchtertool, *i.e.* "the upland of the Tiel," where the stream begins. Struth (Sruth), a stream, is found in Anstruther, *i.e.* the streamy place; Alld, a burn, in Aldie and Kinaldie, and in the name now corrupted to Dundonald, but which appeared in the charter of Alexander I. as Duninald, "the fort of the burn." Abercrombie (of old Abercrombin) is the mouth of the crooked stream, just as the Queich of Kinross is the crooked burn, and the Kaim of Kemback is the winding stream. Ess, a waterfall, confronts us in Kinnesswood, or Kinnescoat, "the wood at the head of the fall." Comair, or Comrich, a confluence, is found in Comrie, and Balquhomary, and Aber, "the mouth of a stream," at various points round the coast, from Aberdour to Abertay. The name for a well appears in Tippermure, "the great well." Fuaran, a cold spring of water, gives its name to Pitfirrane (anciently Petfurrane), "the land of the spring." Meigle, a Pictish word for oozing water (Meigle parish, Perthshire, and Loch Meikle, Inverness), a relative of the Welsh *migen*, a bog, or the Latin *mingo*, gives name to the Miglo Burn of Strathmiglo and the Meikle further west. Lli-afon (Welsh) or Li'abhainn (Gael.) is "the flooding river," the Leven. Glass, an ancient but now obsolete word for water (preserved in Strathglass and Douglas), gives us Kinglassie, the head of the water, and Finglassie, the fair water.

Marshes.—These names, all suggestive of rushing stream and plashing water, show the superabundance of that fluid throughout old Fife, and this is emphasised by the many names signifying marshy land. Thus, near the ancient Loch Rossie lie East and West Lathries, *i.e.* "miry places"; in East Fife we have Lathocker, "the marshy field"; in the north, Lathrisk, "the marshy mire"; and in the west, Lochfitty, fitty (feithe) being a stream through a marsh. The same word appears in Fettykil, "the marshy stream through the wood," the old name of Leslie. The word Leslie itself is not native, but came with the Leslie family from Aberdeenshire. The soft and sodden state of the land is further seen in such words as Balbeuchlie, and Balbougie, "the towns of the boglands." Ladybank (anciently Lathadbog) is the "soft slope," and Calais is the "quagmire." Methil is the "soft land," and reminds one of the ancient tribe of the Meatae (? "fen-dwellers"). Poll, a kindred word to pool, but meaning "mire," gives its name to the Pow Burn in western Kinross, and Powie Burn in north-east Fife, and to Carpow, "the city

of the bog." Indeed, so marked was this state of the soil in the olden time, that when a firmer valley was found, it was distinguished as Strathtyrum, "the dry strath," an ancient example of the exception proving the rule. Again, Pitmenzie is the plot of sedges, Monthrilzean is the moor of marsh-lights, Leuchars means "rushes," as does also the Lothrie, that is "rushy" burn. We have also Larenny, the moor of ferns or breckans; Bangad, the town of withes; Glenshervie, the vale of sorrel; and Freuchie, the heathery place—all indicating mossy soil and thick matted undergrowth. Ptolemy, the geographer already mentioned, says the tribe who inhabited north-eastern Fife in his day were named Vernicomes, which is said to mean in British marshhounds (*gwern-cwn*).

Woodlands.—One cause of this excessive wetness of ancient Fife was the extensive woods that covered much of its surface, making the climate so damp and drizzly that one place is actually named Balbirnie, "the rainy (or dewy) town." The waving woods and dark umbrageous forests of old Fife are represented by the prefix "Kil" or "Kel" that forms part of many place-names; for example, Kellie Law, "the wooded hill"; Haknakel, "the field of the wood"; Kilrie, "the King's wood"; and Kinkell, "the head of the wood."

The plural is "Coilte," found in Kelty and Coilzie in the west, and Cults in the east, the latter making a second plural by adding the English *s*. Gathercauld is "the windy woods"; Drumcaldy, "the ridge of woods"; and Kincaldy, "the head of the woods." The same word forms part of the name of Kirkcaldy, the popular derivation from "Kirk of Culdees" being one of those guesses which owe more to the imagination than to scientific research. The very similar word Dunkeld (Duncalden) means "the fort of the Caledonians," and one is tempted to think that Kirkcaldy is Kir-calden, "the city of the Caledonians." The oldest forms of the words are Kircaladinit, Kirkaladin, and Kircalethin, all written in the twelfth century. Had it been Kirkaldin or Kircalthin, the similarity to Dunkeld would have been complete, but the word is Kircala-din or dinait, which almost excludes this, and points to the Den at Kirkcaldy as the true source of the name, which spells out the "town of the Den Wood." This word "den," it may be said in passing, is not the English word meaning a wild beast's lair, but an old Celtic form *dinait*, meaning "a wooded dell," and appearing in such words as Dinnet, Denny, Edradynate, and all the Fife "dens." In any case, Kirkcaldy is one of many Fife places whose names indicate sylvan surroundings. Carden, the Welsh for wood-brake, gives their names to Cardenden and Kincardine. "Craobh" and "Crann," Gaelic words for trees, appear in Balcurvie, "the town of trees"; Pittencrieff, "the land of trees"; and in Crannock. Then we have many names derived from various kinds of trees. The Lomonds were "the elm-covered hills"; Blalowan, near Cupar, is "the town of the elms"; Lauer is "the hill of elms"; and Ladlanet is "the slope of elms." The native birch appears in Beath, Cowdenbeath, and Halbeath, and in Balbeadie and Banbeath, "the towns of birches." Stravithie means "the birchen strath"; Auchterderran is "the upland of oaks"; Inchdairnie, "the oak pasture-

lands"; and Radernie, "the fort of the oaks." Inchmairnie is "the pasture of blackthorn"; Orwell (anciently Vuerquhell) is "the wood of yews"; Fernie and Collairnie get their names from the alder-tree, Coldrain is "the wood of thorns," and Balsillie and Sillock are named after the willow tree (*seileach*, Latin *silex*). Those names testify to the abundant woods of old Fife, and therefore it is not surprising that its climate and soil were wet.

Moorlands.—But the land was not all wooded. There were occasional patches of bare moorland. Magus Moor, noted in history, means "the bare-end" (*maol-gasg*) moor; Monimail is "the bleak moor," and Balgothrie is "the windy town." In the east is St. Andrews, anciently Kilrymont, "the royal moor"; in the south, Glassmount, "the green moor"; in the north, Formonthills, "the cold moor"; and in the west, Auchtermonzie, "the high moor," and Balmonth, "the moor town." Cluan, a pastureland, appears in Cloon, Cluny, Clunvar, and Clunvan, the latter meaning the fair pastures. Mawcarse is Machar, a plain, with the *s* added for the English plural, and Dunino (1250, Duneynach) is the fort of the open country.

Hills.—The language of the place-names has naturally many words descriptive of hill scenery. Lathalmond and Lathallan are the beautiful slopes, and Lathone the green slope. Airdrie (Dunino) is the King's height; Arncroach, the height of the stack-shaped hill; Clochard, the high rock; and Ardenny (like Ardennes in Belgium), the high hills. Tulloch, the word for a round hill (made familiar in Tullochgorum), forms part of the name of Tulliallan, the beautiful hill; Baltilly, the town of the hill; and Tillywhally, the hill of the wood. Torr is a tower-shaped hill—in fact, the Latin *turris*, English tower. Thus Torbain is the fair, tower-shaped hill, and Torrie is the King's hill. Stronach is the nose-shaped hill; Inzievar is the hill like the point of a finger nail; Burleigh (Barrlia) is the grey-tipped hill; and the Ochils, from the Welsh Vchell, are the high or noble hills. The Binn at Burntisland is the ben or hill; Banchory is the peaked hill; Bandrum (Balindrum), near Saline, is the town on the hill ridge; and Drumain, at the Kirkcaldy Waterworks, is the fair ridge. Bearn is a pass in the hills, and hence we have Kingsbarns, the head of the pass, as well as Cameron (anciently Camberron), the crooked pass.

Rocks.—The word for a rock is always craig, and it appears very frequently. Barncraig is the point of the rock, and Kincraig the head of the rock. Only once have we the more Irish form Carra' in the Carr Rock at Fifeness. Caves such as have been worn by the waves in the soft rocks along the coast are *uamh*—whence Pittenweem, the portion of the cave, and the Wemyss, the caves—of which the older form was Weymet (1240), the place of caves. Cairn, in Irish a heap of stones; but in Pictish a hill, appears in Carnock, Cairneyport, Carnbee, and Dalgairn, the dale of cairns.

Headlands and Islands.—Ross, a wooded promontory, or sometimes simply a wood, gives their names to Kinross the head, Culross the back, and Balross the town, of the promontory. Ruby Point, at Elie, is the point of the headland. Kinghorn (1141 Kingorun, 1280 Kinkorn) is

the head of the horn (Gael., corn, a horn; cor, a curve; corran, a sickle). The old British word is also corn, preserved in the name of Cornwall. Inch (*innis*), when not a holm or well-watered pasture, as in Markinch or the Inches of Perth, is an island, and thus we have Inchgarvie, the rough isle; Inchcolm, the island of St. Columba; and Inchkeith, the island of Keith, one of the sons of Cruithne.

Colours.—No one can study these place-names descriptive of scenery without remarking their extraordinary vividness of painting and the love of colour and beauty thus shown by the race that gave them. Montroy, the red moor, and Cockairney, and still more Cocklawes (*coch*, Welsh for red) the red hill, reveal an ancient flush of purple heather. Lochgelly is (or rather was) the loch of brightness, but Balgrummo is the town of gloom. Deuglie Glen, Devilla Moor, and Devilly Burn all mean black, and Dunduff is the black fort. All these are in Kinross and West Fife, the black country of Pictland. On the other hand, Torbain and Drumain are fair. Knockcannon has nothing to do with artillery; it is simply the fair-headed hill. Montrave is the grey moor, and Glassmount the bright green moor; Dunnikier is the dark hill, but Clushgreen and Craignagreen are the sunny dell and rock. Baluair is the cold town. Skeddoway (anciently Scathochy) is the shady place, but Balmblae is the town of flowers. These names give us not only a picture of Fife as it was, but a picture of such warmth of colour and picturesqueness as could only have come from a nature-loving people.

Fauna.

Animals.—Through this scenery roamed the animals native to Fife. The presence of deer is shown by Monzie, the thicket of the deer, and Dunshalt (Dud-eilid) the stag's hill. Brockley is the badger's haunt; Balmeadowside and Balmadid, the towns troubled by wolves; and Craigencat is the rock of the wild cat. Glentarkie is the boar's glen; Burnturk, the boar's hill; Kilmux, the swine's wood; Auchtermuchty, the swine's field; and Mugdrum, the ridge of swine. Such place-names as these reveal on many a moorland, and in the shade of many an ancient wood, the angry bristles and ferocious tusks of the wild boars native to Fife.

Birds.—Brandyburn is the burn of the black raven; Inchgey, the isle of geese; Pitlochie, the place of wild ducks; Pitfechies, the place of ravens; Thomanean, the hill of the birds; Drumeldrie (Drumelrie), the eagle's ridge; Craigduckie and Minneshock Moss are the places of the hawks; Pitcullo, the place of the moorcock; and Ballinkirk, the place of the grouse. Such and such like was the fauna of Pictland.

Ancient Fifers.

Races of Men.—The human beings who inhabited Fife also figure in the place-names, and we learn much about them. As already noticed, the very language of the names shows the nationality of the people, but the low-statured, swarthy race that inhabited this country before the

advent of either Pict or Scot are also remembered. They were known as the Bolgs, and some remnant of them must have lingered at Dunbog (written in 1190 Dunbulcc), at Blebo (anciently written Bladebolg), and near Kirkcaldy on the lands of Bogie, which were known of old as the lands of Bolgyne. There were not only remnants of these Bolgs but also various settlements of foreigners. Thus we have Ballingall, the town of foreigners (literally Gaulish people), and Lathergoil, the stranger's marsh. Balbarton is the town of the Britons, that is, not the Cruitne or ancient Britons but the Bruitne, later Britons or Welsh, and Balsusney, the town of the Saxons. Dunearn is the fort of Ireland, and Rathillet is the fort of Ulster, while Pitscottie and other names show the presence of colonies of Scots in the neighbourhood of Cupar. Indeed it is pretty evident from the language of the place-names that Fife was latterly entirely dominated by Gaels from the west, partly the result of military supremacy and partly a consequence of the fervid Christianity of Columba and the higher civilisation that followed in its train.

Forts.—The friction of races and the turbulent conditions of life are written large in the names of men's dwelling-places. The word for a fort gave its name to Raith, or, as it is sometimes called, "the Raith," the fort. Ramoir is the great fort; Ramornie (Ramorgany), the fort of Morgan, and Craigrothie the rock of the fort. Dun (akin to our town) is a fortified hill. Dunmore, on the top of Norman's Law, is the "great fort," and Dunfermline is the "fort over the linn" or Linn Burn.

Towns.—Ca'r, a city, sometimes appears Kir, as in Kirkcaldy, but oftener Car, as in Carmore the "great city"; and Carphin the "fair city." Craigsanquhar in Abdie is "the rock of the old city." Bal, a town, occurs very frequently, but grammatical changes sometimes disguise it. Thus the name Channel in Tents Moor appears on Blaeu's map as Shanvell (*seann bhail*), that is, the old town.

Weapons.—The proportion of Duns and Raths to the plain Bals is a good indication of the unsettled condition of the country, and the warlike spirit of the natives is further shown by the names of towns derived from weapons. Balclavie or Bucklyvie (Bucklaweyis) was the "town of the sword"; Claysike is the "enclosure of arrows." Rossyth is the "wood for arrows"; the great bend of the Eden is named "the Bow of Fife" from the native weapon; Dalgetty is the "dale of spears"; Balcarres is the "town of strife"; Knockintinny is the "hill of the beacon-fire"; and Ladenurquhart is the hillside for the practice of archery. Kettle (1183 Cathel) is probably named from Cath, a battle, a word that also appears in Balcaithly, Pitkeathly, and Buchadlach.

Agriculture.—But agricultural and pastoral pursuits were not entirely unknown. Torloisk, the burnt hill, and Tents Moor, the moor of fires, show that land was first cleared by burning away the brushwood and undergrowth. Auchentinny, the field of fire, and Luthrie, ashes, confirm this view, and that the practice was continued down to Saxon times is shown by the names of Brunton, Bruntsfield, and Burntisland. The land thus cleared was termed the achaidh or field, hence the number of places whose names begin in Auch. When enclosed they became a gart,

similar to our word garden, or the yaird, of the kailyaird novelists. From this we have Gartary and Gartwhinzean. A plot of land was a Cavil (that is taken), whence Cavilston, and an extent of land equal to two ploughshares was a davoch, whence Inchdattie and Datty Mill, and Dachy the ancient name for Newbigging. Por or Pawr, the Welsh for grazing, which appears in Pictland as Porin (Ross) and Dochfour (Inverness) gives names to Pouren (Falkland), Pitfour, grazing plot, Balfour, grazing town, Fourlums, grazing fields, and Prinlaws, pasture hills. Tullibole is the hill of cattle folds. Blawhidder is the cotters' town, and their Coitchionn or Commonty gave its name to the village of Cotton, and to Kitchengreen, that is, the "sunny common." Lios, the garden, gave name to Collessie, the back-lying place of the garden. Lochornie, the loch among the barley, speaks of sowing and reaping. Saline (that is, barns) speaks of the ingathering. Strabo was the strath of cows (the bovine strath); Carnbo, the hill of cows; Tarvet is the place of bulls (from the word *tarbh*, akin to the Latin *taurus*, a bull); Aldendeich, the burn of horses; Capeldrae, the place of horses (from "capull" which through Latin and French is the ancestor of our cavalry). Pittich, Strathore (Blaeu), the horses', and Pitlair, the mares' field. Some light is thrown on these names by the fact that David I. in 1128 granted to the abbey of Dunfermline all the wild mares taken in Fife. Banacarron is the town of "gelding horses." Balmuto is the "town of sheep," from an old Gaelic noun *mult*, which through the French gives us the word mutton. Inchkerie is the sheep's pasture; Kilkerrie, the sheep's wood; Bangour (Balnagour), the town of goats; Carngour, the hill of goats; Kilgour, the goats' wood; and Knaggour, the hill of goats. Markinch is the pasture-land rented for a merk.

Other Avocations.—Nor was agriculture the only pursuit, for we have Achentelketye, the hunter's field; Womanhill, the wolfman's hill. Balvaird, Drumvaird, and Monybard are the bard's town, the bard's ridge, and the bard's moor. Balwearie (from *maor*) is the high officer's town. Balgonie is the smith's town: and the Inneans of the Cleish hills are the anvils. Knocksudrom is the tanner's hill; Pitbrog is shoeland; Pittencarty, the smith's or tinker's field; Pittenchar the fuller's place; and (most significant) Balgedie, the town of thieves; and Dunimarle, the robber's fort.

Paganism.—A few of the older names betray the paganism of the Picts. Balhelvie is the town of the goddess Fortune, and Beley is the place of the great Celtic god Bel. Glenshee is the glen of fairies; Pittendreich the Druid's place, and Drumshandry is "the ridge of the old druid."

Christianity and Church.—But the new faith left a deeper mark on our place-names. Balchristie is the town of the Christian; Bantuscall the town of the Gospel; and Pettuscall the portion land of the Gospel.

Navity is a very old Gaulish and British word for a sacred place (modern Gaelic, *naomh*) and denotes the church land.

It was through the Church, and not through the power of the Roman legions, that the Roman language had any influence in Fife. Most of our ecclesiastical place-names are Latin in essence, though Gaelic in

form. Thus the lands of Bennochy are the "lands of blessing," that is lands dedicated to the Church, the word being derived ultimately from *benedictus*. Montaggart is the priest's moor, and Ballintagart, the priest's town, from *sagart* (Latin *sacerdos*), a priest. The Latin *ecclesia*, a church, becomes in Gaelic *eaglais*, whence we have Pettnahaglis and Dumnahaglis (Kirkton and Churchhill). Near Aberdour was a church dedicated to St. Maline, and in 1169 the name of the place was written Eccles Maline; by and by it became Egismale, and now it is sunk to Legsmalee. The hermit's cell was named the Diseart from the Latin *deserta*, and hence we have the name of Dysart from the hermit's cave of St. Serf.

The Abbeys of Dunfermline and Lindores gave their names to Abden, that is "Abbey lands," at Kinghorn, and Abdie on the Tay.

Saints.—Kil, the well-known word for a church, is the Latin *cella*, the cell of a monk. All the Celtic Church missionaries were monks, and many of them by their goodness and sweetness so endeared themselves to the people, that in the affectionate tongue of the race they were called not saint but a fonder name. For example, the missionary we would call St. Ron, they always called "My own Ron," as in our place-name Kilmaron; or "My Dear Little Ron," as in Kilmaronock. Balmerino (older Balmerinoch) is "the town of My Dear Little Ron." Balmalcolm, near Kettle, is not the town of Malcolm, but "the town of my dear Colm"—that is, Columba. This great saint is also commemorated in the name of Inchcolm, near Aberdour, the "St. Colme's Inch" of Shakespeare.

Mon or Monan is similarly remembered at St. Monans, and a chapel to St. Ninian existed at the village now known simply as Chapel. Lumphinnan is the Church of St. Finnan, Llan being the British word for a church.

Notable Picts.—The place-names embalm not only the names of saints but also those of sinners, or at least pagans.

Unguis, an old Pictish king, it is suggested by Sheriff Liddall, who has written an interesting little book on place-names, may be commemorated in the name of the Hungrie hills, and probably in Ballingry; and Ulfa, a son of old Cruithne, the eponym of the Picts, is immortalised in Balhouffie. Even Gruoch, the bad queen of Macbeth, has dedicated to her fame Growoky's Well.

Fife itself is said to be a personal name. In a verse ascribed to St. Columba the different provinces of Scotland give names to the sons of Cruithne, much as in Genesis the different countries bear the names of grandsons of Noah :—

> Seven children of Cruithne
> Divided Alban into seven divisions
> Cait, Ce, Cirig (a warlike clan),
> Fib, Fidach, Fotla, and Fortren.

Cait is Caithness, Fotla is Atholl, and Fortren is the Forth, and Fib is of course Fife. This, however, does not help us much, for the word probably belongs to a lost tongue.

It is curious to note that as a rule the larger the place the older is its name. The word Fife itself is so old as to be now unintelligible. The Eden and the Lomonds are probably Pictish, the Ochils are British, the smaller hills and districts modern Gaelic, and when we come down to the smaller farms and fields we find the names are Saxon or plain English.

However, to return to the personal names of Picts, Drinkbetween is Dun-ic-Brenan, the fort of the son of Brenan; and Donibristle is the fort of Bearsall; Rathelpie is the tower of Alpine; and Balleave the town of Hugh. The British hero, King Arthur, is commemorated in various parts of Fife, especially in the west. Benarty, overlooking Lochleven, is the hill of Arthur (originally Cebenartye, from British *cefn*, a head); Craigarter is his rock; Clocharthaw, his great stone; and Pittarthie, his plot of land.

These names remind us that we are in the region of the Arthurian legends of the British or Welsh people, while there is not one place in Fife connected with the Ossianic legends of the Feinne that give so many place-names in the Gaelic regions of the west and north.

Norse Names.—Of Norsemen, one Otter gave its name to Pittotter and Otterston, and both Carriston (anciently Karretstoun) and Crail (anciently Corell) are framed from the Norse Carrel. But in spite of their repeated attempts to invade Fife, we have few remains of the Norse Vikings in our place-names. In North Fife we have the Norman's Law; and in the west, Fordell—that is, the fore-dale. As might be expected, we have a few Norse words by the sea. Hope, the Norse for an anchorage, we have in St. Margaret's Hope and in Lerhope. The Firths of Tay and Forth are but the Norse fjord; the Isle of May is the Norse *ma-ey*, the isle of gannets or gulls; and the Vous rocks, near Kirkcaldy, are from the Norse *voe*, a little bay inside a reef. But Fife cannot show one Norse name for any of the many bays and promontories round her coast. In place of the Norse *wick* we have the Welsh *cwr* or Gaelic *curr* in Pettycur, and in place of Cape we have the Gaelic *rudha* in Ruddon Point, near Largo. We have, however, Ness for headland in Fife Ness.

Norman.—From the Norman-French we have Bouprie—that is, *Beau-pre*, beautiful plain—near Aberdour; and the strange word Demons, which is a corruption of the French demesne, or policies.

Dutch.—From the Dutch, we have Buckhaven; for although writers on this subject put it down as Gaelic, meaning Evan's town, tradition, with much probability, says that a crew of Dutchmen were wrecked here and formed the origin of the village, which they named Backhaven, the harbour-bank.

Saxon.—The Saxons were settlers in Fife from a very early date, and from their tongue we have Queensferry, named from St. Margaret; Cadham, the "cauld hame"; and Letham, the "laich hame." The oldest burgh in Fife is curiously enough named Newburgh. It appears as Niwanbyrig in 1130, and is then said to have existed in 750, so that it is not quite so "new" as it pretends to be. Crossgates and Windygates preserve the old Scotch word *gait* for a road. "The Path," at

Kirkcaldy, is not a path at all, but an old Scotch word *peth*, meaning a road up a hillside. Ravenscraig was of old Ravensheuch—that is, the haugh or wooded dell of the raven. Linktown is the village on the links or seaside common; Sinclairtown is named from the Rosslyn family, the Lords of high St. Clair; and Gallatown is the town of the gallows. The Saxons were always the race that stood up for law and order, and they were the first to make the gallows one of the regular institutions of Fife. They also gave us a Branxton—that is, the place where the iron collar for culprits was kept; Demperston, for the Demster or Judge; and the Cronarland, for the Coroner. The Saxon also gave us the oldest extant name from the coal-mining industry—Colheuch (Cardenden, Blaeu). But even the Saxon names have undergone strange changes. Chance Inn is not a tavern that you happen to drop into accidentally, but the old "change house" where the horses were changed. Lizziewells was originally Lawteishoill, the hollow of somebody called Lawtis; Hilary was (like Bennochy) the Holy Rig, and had nothing hilarious about it; Mannerless is the Manor Leas; Breadless, the Broad Leas; Liquorstone, the lecker or dead-body stone on which the coffins were rested; and Lingo, Cuffabout, Tailabout, and Standalane are as mysterious as if they had been Pictish in place of apparently Saxon names.

One curious feature of the names of Fife is that Gaelic words so often appear with English plurals, as in the case of the Wemyss or caves. Thus, the Bungs of Cassingray are really Beinn, a hill, with the Saxon *s* added.

These old place-names disclose to us a perfect picture of ancient Fife as a "land of brown heath and shaggy wood, land of the mountain and the flood," and they are rich in human interest of a pensive kind. They are all that are left of a vanished race; their enduring monuments, and their only literary remains.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings in November.

Mr. Harry de Windt addressed the Society as follows on his journey from Paris to New York, overland:—Edinburgh on the 10th, Mr. William C. Smith, K.C., in the Chair; Glasgow on the 11th, Dr. Paul Rottenburg in the Chair; Dundee on the 12th, Mr. I. Julius Weinberg in the Chair; and Aberdeen on the 13th, Mr. John Clarke in the Chair.

On the 27th Captain C. H. D. Ryder, Royal Engineers, read a paper in Edinburgh on his Explorations in Western China. Professor Cargill G. Knott presided.

Meetings in December.

On the 4th, in Edinburgh, Captain Richard Steel, 17th Bengal Lancers, read a paper describing the condition of Peking under the Allies. The Chair was taken by Colonel Cadell, V.C.

The Anniversary Meeting.

The Anniversary Meeting was held in the Synod Hall, Edinburgh, on the 16th December, and was addressed by Dr. Sven Hedin, who gave an account of his recent work in Central Asia. The President of the Society occupied the Chair. Before the delivery of the address, Sir John Murray, in the name of the Council, announced that Dr. Sven Hedin had been appointed an Honorary Member of the Society, and that the Livingstone Gold Medal had been awarded to him, both honours having been conferred in consideration of the distinguished services he had rendered to geographical science by his explorations in Central Asia.

Dr. Sven Hedin addressed the Aberdeen Branch on the 17th, Professor J. Arthur Thomson presiding; he addressed the Dundee Branch on the 18th, Mr. I. Julius Weinberg being in the Chair; and the Glasgow Branch on the 19th, when Dr. Paul Rottenburg presided.

GEOGRAPHICAL NOTES.

ASIA.

The Turkestan Earthquake of August 22.—Information received in India leaves no room for doubt that the earthquake of August 22, which left such conspicuous traces on the seismographs of Europe, had its origin in Central Asia. The representative of the Indian Government at Kashgar reports that there was a severe earthquake there at 8 A.M. on August 22, which lasted one and a half minutes. Repeated shocks were felt throughout the day, and shocks are reported on every day up to August 30. At 10 P.M. on September 2 a very sharp and severe shock was felt. It is said, though this has probably no direct connection with the earthquake, that the disturbance was followed by extreme heat, which lasted, at any rate, to the end of the month.

At Kashgar a good number of walls, made of sun-dried bricks, were knocked down, but masonry buildings do not seem to have suffered; sixteen deaths are said to have occurred through falling of houses. In the Artush district, to the north of Kashgar, the damage was much greater; nearly all the houses—presumably built of sun-dried brick—are said to have collapsed, and 667 deaths are known, besides more than a thousand persons severely injured. In Russian territory north of the Tian Shan range the shock appears to have been less violent, and it is reported that the damage done at Narin and Atbashi was not great. In the opposite direction the shock was felt at Yarkand, whence three shocks are reported to have been felt between 9 and 10 A.M. Some damage was done to the city wall and some private buildings; two children were killed by walls falling on them.

These particulars are sufficient to show that the earthquake was one of the first order of magnitude. Yarkand and Narin, at both of which it was destructive, are about 240 miles apart in a straight line, but are not sufficient to determine with certainty the position of the epicentre. This was evidently either to the east-north-east of Kashgar or more probably to the west-north-west among the mountains of the Alai Tian Shan range. It may consequently be taken that this earthquake, which will probably never be the subject of a detailed study, originated in about Lat. 49° N., Long. 74° E. of Greenwich.—*Nature.*

Explorations in the Kara Sea.—According to the *Journal de St. Pétersbourg* the Warnek expedition, which has been exploring the maritime route to Siberia through the Arctic Ocean, has recently returned to St. Petersburg. It is said that the expedition has been able to make a survey of the banks of the Kara Sea from the Yougorski-Schar to the river Kara. In exploring the Vaigatch Channel between the islands of New Siberia and Vaigatch, a bay has been discovered where vessels would be able to winter in entire safety. This discovery is of great importance in regard to the future of navigation in these regions of the extreme north. Moreover, the expedition has proved that the great depths shown on maps of the Kara Sea are inaccurate. Captain Warnek has also measured the depth of the Petchora Channel. It is said that the exploration of the Kara Sea will be continued next year, and will probably last for two years.

AMERICA.

The Eruptions in St. Vincent.—The Colonial Office recently issued a despatch from the Governor of the Windward Islands to Mr. Chamberlain, enclosing reports from the Administrator of St. Vincent on the eruption which took place in that island on October 15 and 16. The Governor says :—"I regret to observe that there has been a large increased area of land damaged by this last outburst, and the prospects are now much blacker than they were. Coarse, gritty sand or small stones seem to have fallen as far south as Argyle estate and in the Marriaqua Valley, and I notice with deep regret that the peasants settled on the acquired estates of New Adelphi and Park Hill have had all their ground provisions, nearly ready for reaping, destroyed. It is a matter for serious consideration whether Georgetown, at present deserted, may not have to be abandoned, and if another violent eruption takes place, and this time drifts to the west instead of to the east, as on the 13th inst., then Chateaubelair, down as far as Mr. M'Donald's property at Wallilabo, will be destroyed. The areas of safety for dwellings and cultivation are gradually getting reduced, and even if land is acquired at the south end of the island, and all the people crowded there, I do not know how they can exist except in poverty and distress. I had no idea until the receipt of the report that the damage done was so serious, and it is a matter for grave consideration, and one on which I am afraid I can give no decisive opinion, whether any part of the island can confidently be said to be without the range of danger from this terrible volcano. It is most distressing to have to write this of what was certainly a beautiful island six months ago ; but I am afraid it must be faced. The south-eastern end of the island is badly off for water, and I am afraid if more people are crowded there they would not be able to exist."

AUSTRALASIA.

The Drought in Australia.—We have received the following, under date of Oct. 14, from the Rev. J. Bryant of New South Wales :—"The drought still prevailing in New South Wales, affecting Queensland also, and to a less extent Victoria, is significantly marked by the total drying-up of Lake George. This is the largest of the lakes of New South Wales. Its area is variable. When full it is 20 miles long, with a width averaging 7 miles, and a maximum depth of 21 feet. It contains brackish water. A few creeks flow into it, but it has no visible outlet. It is one of the few lakes of the mountain system, and lies 2200 feet above sea-level.

"In the Western District the drought has wrought fearful havoc. The Darling

river is reduced to a narrow, stagnant pool. Peri lake is one of a long chain of lakes lying back from the Darling 40 miles west, and connected with it by the Marra channel, which backs out from the Darling till it meets the Paroo river. Peri lake is fed by both these rivers when in flood, and when full is 38 miles in circumference. It has been quite dry for some time past, as have also the numerous lakes in line with it.

"The effect of the drought on the pastoral industry may be judged from some specific instances. Mount Murchison and Momba station, on the Darling and Paroo rivers, is one of the largest holdings in New South Wales. In 1890 and 1891, 300,000 sheep were shorn, besides nearly 100,000 sent away before shearing. Continual decrease has reduced the number this year to 40,000. An adjoining station, Monolon, formerly reckoned one of the best of the Far West holdings, has been abandoned. Farella, twelve miles from the White Cliffs opal-fields, usually a well-watered holding, and carrying in ordinary seasons 90,000 sheep, has had its numbers reduced to 26,000. It is estimated that the flock in the whole of New South Wales, which averages sixty millions of sheep, has been brought down already by the prolonged general drought to twenty millions."

POLAR.

Scottish National Antarctic Expedition.—We publish this month a photograph of the officers and staff of the *Scotia*, now on her way to the Falkland Islands. Particulars are now available of the journey to Madeira, which was reached on November 20. After leaving Troon, the vessel called at Kingston, where she was detained for nearly a week owing to head winds. To struggle against these would have resulted in a great expenditure of coal to little purpose. Kingston was left on Saturday, November 8, but the boat experienced a heavy south-westerly gale as soon as she put to sea; and as little progress was being made, she put into Wicklow Bay for the night. The voyage was resumed the next day, but heavy weather still prevailed, a strong gale from the south blowing for about twelve hours. The boat was put under steam, and at three-quarter speed she made about six knots an hour. Sail could only be used for about three hours at a time owing to persistent head winds. The vessel proves to be a good sea-boat, but she rolls a good deal, the greatest roll as shown by the clinometer being 37°, which is somewhat heavy. She steers well and is economical in coal consumption, both very important points in Polar navigation.

During the first part of the voyage the scientific staff was chiefly occupied in the fitting up and arrangement of the two laboratories, the photographic dark room, and the library. It is satisfactory to learn that none of the instruments were found to be in any way damaged by the rolling of the ship. On the morning of November 20 the *Scotia* anchored in Funchal Bay, Madeira.

Details of the scientific staff have already been given in our pages. As regards the navigating staff, it may be noted that Captain Thomas Robertson has under him as first officer Mr. B. A. Thomson, late of the Clan line; the second and third officers have previously sailed with Captain Robertson to the Arctic, and have both had extensive experience of ice navigation. The total number on board the *Scotia* is thirty-seven.

On the voyage to Madeira, a considerable amount of meteorological work was done by Mr. Mossman. For the routine work a form of Stevenson Screen for use on ship board is employed. There are two of these, and as the readings are taken from the one on the weather side, they are made always in a current of air, which is uninfluenced by heat generated from the engine rooms or saloons. Continuous

SCIENTIFIC STAFF, OFFICERS, AND CREW OF THE SCOTTISH ANTARCTIC SHIP *SCOTIA*, NOVEMBER 1902.

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traces of the fluctuations in pressure, temperature, and humidity are obtained from automatically recording apparatus which register on revolving drums driven by clockwork. Rainfall observations are made by means of a marine rain-gauge, the invention of Dr. Black, which is exposed clear of the deck on the weather side. Other instruments employed are the pocket dust-counter by Mr. John Aitkin, F.R.S., for counting the number of dust particles in the air; and the statoscope, "an extremely delicate barometer" for measuring the height of the ocean waves by the difference in atmospheric pressure between the trough and the crest. Kites, which will carry instruments to be employed in investigating the meteorology of the upper air, and a specially constructed camera for taking aerial photographs, were flown in the Bay of Biscay. The initial kite experiments, extending over two years, were conducted under the direction of Mr. John Anderson, whose services and advice have had much to do with the success which has attended these new and important investigations.

While the *Scotia* was coaling at Madeira, the members of the staff had an opportunity of making observations in regard to the botany, geology, and zoology of the island. The vessel quitted Madeira on November 23, setting her course for Port Stanley, Falkland Islands, where she expects to arrive about the middle of January. A final supply of coals and fresh provisions will be taken on board there, and the *Scotia* will then start for her work in the Antarctic.

Mr. Bruce writes to Sir John Murray from Madeira as follows:—"As far as possible scientific work has begun, but observations and collections have been restricted so far to such as are compatible with keeping the ship going. Thus meteorology and plankton collecting and examining form most of the scientific work done. The ship is a great success as far as we have been able to judge, though we have not yet had a fair quarter breeze to test her sailing powers; doubtless we shall have this before we reach Port Stanley."

Flora of South Georgia.—In the *Geographical Journal* for November, C. Skottsberg of the Swedish Antarctic Expedition gives an interesting account of the plants of this barren land. Owing to the shape of the country, and its general altitude, only a small area is available for plant life. The low ground is of very limited extension, and consists of narrow valleys separated by steep ridges, and of the level beach, covered by sand and pebbles. The climate is very severe, largely owing to the strong wind, and slopes exposed to the winds are much poorer than those which are more sheltered. To summarise first the general characters of the flora—fifteen species of phanerogams, four ferns, sixty-three mosses (Musci and Hepaticæ), and twenty-six lichens are now known. Of the flowering plants one of the most interesting is the Tussock grass (*Poa cæspitosa*), which may reach a height of from three to five feet. It grows best on the level beach, but also ascends the glens of the mountains to a height of 800 to 950 feet. It always avoids the moist ground. Where this grass is absent on the level ground, and the soil is not too wet, other grasses occur forming a dense turf, and ascending the hills to a higher level than the tussock grass. In the damper places, the grass *Aira antarctica* occurs, forming patches of some square metres in extent. The Swedish expedition found for the first time in South Georgia the grass *Poa pratensis*, in a locality near a harbour visited by whalers and other vessels. Apart from grasses, flowering plants are rare; in the streams grow Water-starwort (*Callitriche*), while a water-crowfoot (*Ranunculus biternatus*) is found alike in the streams and in boggy ground. A rush (*Juncus Nova-Zelandiæ*) and a small Cross-wort (*Galium*) almost complete the list. The mosses are often luxuriant, species of *Polytrichum* especially forming large, extremely hard knolls. Lichens

are also abundant, and are the only plants which extend to the higher crests, which are swept bare by the dreadful gales. In the more sheltered places on the mountains the very common lichen, *Usnea melaxanthus*, reaches a height of about 3½ inches and fruits abundantly; it is characteristic of mountain regions in the Antarctic and sub-Antarctic areas.

GENERAL.

Camels as Draught Animals.—A German veterinary surgeon, named Schmidt, has succeeded in training camels to draw carts. He has employed them in transporting stones, cement, and other building materials in the neighbourhood of Dar-es-Salaam. They covered 15 miles a day with loads up to nearly 6 tons, but Herr Schmidt recommends that the load for two camels should not exceed 3 or 4 tons. To transport 3 tons a distance of 15 miles would require 50 native porters, at a cost of 16s. 8d. a day (taking the rupee at 1s. 4d.). The wages of a driver and the keep of the camels would amount to 1s. 8d. per day, and the total expense for 300 days in the year, including the cost of camels and carts, Herr Schmidt estimates at £80, during which time the work done would cost fully £240, if porters were employed.—*Bull. de la Soc. d'Études Coloniales.*

The captain of a French vessel, the *Félix Touache*, has invented a compass, which by electric contact rings a bell in the cabin of the captain or officer of the watch whenever the vessel's head deviates beyond any chosen angle from the course set, and also registers the course of the vessel by means of a pencil attached to the needle, and moving over a sheet of paper placed underneath the compass-card.—*Bull. de Géographie et d'Archéologie* (Oran), Tome xxii., Fasc. xcii.

Observations on Gravity.—As a result of observations taken by Dr. Hecker between Hamburg and Rio de Janeiro, Dr. Helmert of the Royal Geodetic Institution at Berlin reports that the high value of the force of gravity observable on small oceanic islands does not extend over the ocean, while, on the other hand, the apparent defect of mass in the space occupied by the ocean does not cause a great diminution in the value of g, which is, perhaps, only 0·032 cm. per sec. less than in the shallow sea near the coast. —*U.S. Monthly Weather Review*, July.

In the *Bulletin* of the American Museum, vol. xvi., Dr. Duerden treats of the action of boring algæ on coral. Almost all fragments of dead coral in the West Indies are perforated by tunnels of an alga, and Dr. Duerden believes that these organisms have a greater share in the formation of lagoons than the carbonic acid contained in the water.

Malaria in India.—In the report of the Council of the Royal Society of London, read at the anniversary meeting on December 1, some reference was made to the attempts which have been made under the auspices of the Royal Society to reduce malaria in India by practical measures. In the highly malarious cantonment of Mian Mir a considerable measure of success has been obtained, although the amount cannot be fully estimated until the end of the fever season. The Indian Government is taking the greatest interest in the carrying out of the scheme.

Sleeping Sickness in Uganda.—Reuter's Agency understands that the work of the Commission despatched to Uganda some months ago by the Royal Society and the Foreign Office to inquire into the cause of the mysterious malady known as sleeping sickness, which has made such ravages in Central Africa, has not yet been completed. Dr. Low, the pathologist of the Commission, having finished his

portion of the work, is returning home, but Dr. Castellans is continuing his bacteriological investigations in the country, and Dr. Christy, the third member of the Commission, as at present arranged, will pursue his studies along the Upper Nile, by which route he will return to England. Until their work is completed no authoritative decision can be announced with reference to the cause of the malady. The investigations made, however, point to its being of bacterial nature. Its connection with malaria seems to be disproved.

COMMERCIAL GEOGRAPHY.

Mining in New Caledonia.—The mining industry in New Caledonia was very flourishing in 1901. Sixty-eight concessions were worked, covering an area of 41,115 acres, and 152,081 tons of ore were extracted, almost all of which was exported. The nickel mines gave employment to 2825 out of the total of 3493 miners. The output was 131,350 tons, and in addition 17,342 tons of chrome iron-stone and 3389 of cobalt were obtained. The coal of New Caledonia is not worked though it has been found to be as good as Australian coal.—*Questions Dipl. et Coloniales*, and *Le Tour du Monde*, No. 47.

New Railways.—A concession has been granted for the construction of a railway from Cameroons to Adamana. It is to run from Victoria or Duala through Mundame, Tinto, and Bali, with a branch to the Manenguba and Bakossi mountains, or from Duala through Yabassi to Tibati. Its length will be about 250 miles, and the gauge 1 metre (39 inches). The line must be open to traffic on July 1, 1908. The Government does not grant a subsidy or guarantee interest, but assigns the company about 124,000 acres in the Manenguba and Bakossi mountains and the available crownlands on either side the line. The region through which the railway will pass is extremely fertile and suitable for plantains, and also contains abundance of india-rubber. The concessionaires look forward to continuing the line eventually to Lake Chad.

A concession has been granted by the Portuguese Government to Mr. Robert Williams for a railway from Lobito bay, near Benguella, to the eastern frontier of the Angola territory. The concession includes the right to all minerals within 75 miles of the line. Lobito bay is a very fine harbour with an area of fully 1000 acres, and anchorage down to a depth of 21 fathoms.

A new railway has been planned to run from the upper Angara to the Vitim, a distance of 600 miles, and the details are now being worked out. The line will tap the richest gold-mining districts of Siberia.

Forestry in Ontario.—Mr. Thomas Southworth, the Director of Forestry for the Province of Ontario, in a recent report states that although the Province only has at present about 2,634,000 acres in forest resources, he does not think it unreasonable to expect that ultimately they will comprise fully 25,000,000 of acres—a State forest larger than is possessed by any other country. Already, with the existing wasteful methods, and when only a small part of the territory is being operated, the Province receives in revenue from the forests about 1,000,000 dollars per annum, which would be enormously increased if they were placed under scientific control and systematically worked. The composition of the forest would include a large quantity of spruce and birch and furniture woods, but it is the natural habitat of the white pine, the tree that has been so largely the cause of the unique

position occupied by the Province of Ontario—a country without a debt, where the people are not subject to any direct tax for debt repayment and interest.

The Chile-Argentina Boundary Arbitration.—The great Cordillera of the Andes was defined to be the boundary between the Spanish provinces of Chile on the one side and of the River Plate and Tucuman on the other, and in later times has been recognised as the frontier between the Argentine and Chilian republics. Simple as this definition appears at first sight, its precise interpretation has, owing to certain peculiarities in the orography and hydrography of the border lands, been the subject of negotiations between the two governments during the last half century. It was at first believed that the question was settled when the treaty of 1881 was signed, in which it was decided that the frontier down to lat. 52° should pass along the highest crests of the Cordillera of the Andes which divide the waters and pass between the slopes down which the waters flow to one side or the other. Immediately, however, the Chilians and Argentines put forth different opinions as to the meaning of these words, the former claiming that the continental watershed was the line intended, while the latter defined it as the line of the highest elevations, even where these were broken through by rivers flowing to the Pacific. The Puna of Atacama in the north lies between two chains, the Cordillera Real on the east and the Cordillera Domeyko on the west, and was claimed by both States. In this case the arbitrator, Mr. Buchanan, United States ambassador, divided the country between the contending parties, assigning the larger half to Argentina (see *S.G.M.*, vol. xv. p. 380). It now constitutes the Argentine territory of Los Andes. As regards the boundary southwards, it was decided by the Agreement of 1896 that disputed points should be referred to the British Government as arbitrator. The section where the conflicting claims were most difficult to reconcile is that from the lake Nahuel-huapi southwards, for here all the rivers flow through the main Cordillera from a watershed of no great relative height, which has been crossed by many Argentine colonists who have settled in the valleys on the eastern flank of the Andes. Some lakes in this region send their waters to both oceans, and in the extreme south fiords break through the Cordillera.

The award of King Edward has been recently given, and, as in the case of the Puna of Atacama, is of the nature of a compromise. The Chilians acquire the larger area (about 21,000 square miles), while the Argentines receive the most fertile lands (about 15,000 square miles). Four points were submitted to arbitration. The first regards the boundary on the south of the Puna of Atacama, which it is decreed shall be formed by the line of water-parting extending from the pillar already erected on that pass (San Francisco) to the summit of the mountain named Tres Crucas. The basin of lake Lacar is awarded to Argentina. In the south the boundary is to pass from the Perez Rosales pass, near the north of Lake Nahuel-huapi, past Mt. Tronador to the river Palena across certain fixed points on the rivers Manso, Puelo, Futaleufu, and Palena, so that to Argentina are awarded the upper basins of those rivers, including the valleys of Villegas, Nuevo, Cholila, 16 de Octubre, Frio, Huemules, and Corcovado. From the Palena the boundary runs along the river Encuentro to the peak called Virgen, and thence by a fixed line across the lake General Paz and by the water-parting to a fixed point on the river Pico, thence to the continental watershed on the Loma Baguales which it follows to a summit locally known as the Galera. By the peak Ap Ywan it proceeds to a certain promontory on the shore of Lake Buenos Aires. The lower basin of the Pico belongs, accordingly, to Chile, and also the whole basins of the Cisnes or Frias and of the Aisen, except a tract on the southern branch of

the latter in which the settlement Koslowsky is situated. The further continuation of the line is drawn across the lakes Buenos Aires, Pucyrredon or Cochrane, and San Martin to Mt. Fitzroy. The boundary from Mt. Fitzroy to Mt. Stokes has been already determined.

South of Mt. Stokes the new boundary follows at first the continental watershed along the Sierra Baguales, then diverges southwards across the river Vizeachas to Mt. Cazador, at the south-eastern extremity of which it crosses the river Guillermo and rejoins the continental watershed to the east of Mt. Solitario, following it to the 52nd parallel of latitude, where the boundary is already fixed.

Colonel Sir Thomas Holdich has left England for South America, accompanied by three officers. He will supervise the demarcation of the frontier, and set up the boundary marks.

NEW BOOKS.

EUROPE.

Through the Casentino. By Lina Eckenstein. London: J. M. Dent and Co., 1902.

This little guide-book for the Casentino, *i.e.* the upper valley of the Arno, fully sustains the high reputation of Dent's series. It is far more than an ordinary guide-book, being full of interesting historical lore regarding a locality inseparably associated with the memory of St. Francis, together with notices of the condition and customs of the present inhabitants. The illustrations are numerous and excellent.

Britain at Work: A Pictorial Description of our National Industries. London: Cassell and Co., 1902. Pp. 384. *Price* 12*s.*

"Though Britain is the greatest hive of industry in the world, it is curious how little the average Briton knows of the primary sources of the nation's greatness—her Industries. We supply the world's markets with every commodity required by man, but comparatively few of the forty-one millions of inhabitants of the British Isles possess any definite knowledge of the wonders of art and craft which are to be found in every workshop throughout our own country." This splendidly illustrated, well-written work supplies that want and describes the industrial life of the United Kingdom, more particularly of England, for a similar work on industrial Ireland (reviewed December 1902) is the best guide to the sister island, whilst an equally good work on industrial Scotland has yet to be written.

Highways and Byways in London. By Mrs. E. T. Cook. With Illustrations by Hugh Thomson and F. L. Griggs. London: Macmillan and Co., 1902. Pp. 480. *Price* 6*s.*

Cleverly written, admirably illustrated in the most amusing manner, this volume should appeal to every one who takes an interest in London, "the history of which," says the authoress rather loftily, "as was that of Rome in ancient days, is the history of the whole civilised world." She lovingly describes the greatest metropolis the world has ever seen—its river, its commercial centre the City and its antiquities, its cathedral of St. Paul's, the Tower, Southwark, the Inns of Court, East and West London, Westminster, Kensington and Chelsea, Bloomsbury, London's theatres, shops, markets, galleries, museums, and historical associations, in the course

of which she makes many a sly joke regarding Londoners and their ways. She concludes with the remark that "it is a curious fact that the fine passages which everybody knows and quotes about the stones of London all refer to them in ruins." Macaulay's New Zealander standing on a broken arch of London bridge, Shelley's picture of London as "an habitation of bitterns," Rosetti's comparison of the ruins of London and Nineveh, and Ruskin's allusion to London's stones crumbling "to less pitied destruction," all bear out our authoress's original observation.

The New Guides. London: Grant Richards, 1902. *Price* 2*s. each.*

The Channel Islands. By E. Gallienne-Robin and Harold Child.
Stratford-on-Avon and the Shakespeare Country. By Harold Child.

The New Guides are eminently practical. The descriptive text is concise and to the point, dealing with the country in a series of excursions. There are numerous rough sketch-maps in the text, and the Stratford-on-Avon guide has a good district map reduced from the Ordnance Survey. Convenient in size and in strong binding, the guides are well adapted for pocket use.

La Haute-Savoie: Guide du Touriste, du Naturaliste, et de l'Archéologue. Par M. Marc Le Roux. Paris: Masson et Cie. *Price* 4 *fr.* 50.

For the student and the intelligent tourist this little handbook is a perfect compendium of all the natural attractions and features of interest in Haute-Savoie. In a way quite unknown in English guidebooks, it deals systematically with all the natural phenomena of this region—geology, orography, hydrography, climate, flora, fauna, anthropology, archæology, history, *l'homme actuel*, agriculture, mineral products, commerce, industry, and administration, after which it conducts the tourist all over the country describing the various places of interest and their attractions. The illustrations and maps are numerous and admirable.

Ward, Lock and Co.'s Illustrated Guide-Books. London: Ward, Lock and Co., Limited. *Price* 1*s. each.*

Isle of Wight. Map and 70 Illustrations.
Switzerland. Map and 50 Illustrations.

The new editions of these guides are greatly improved. They are well printed, compact, handy, and attractively illustrated. They are admirably adapted for the requirements of the sight-seeing tourist.

Pearson's Gossipy Guides. London: C. Arthur Pearson, Limited. *Price* 1*s. each.*

The Western Highlands. 3 Maps and 80 Illustrations.
Bournemouth and District. 2 Maps and 70 Illustrations.

These popular new guides are well described as "gossipy." They appear to be written from personal experience, and first-hand information is of the greatest importance in a guidebook. The illustrations are well selected and clearly printed.

The Mediæval Town Series. Prague. By Count Lutzow. London: J. M. Dent and Company, 1902. *Price* 3*s.* 6*d.*

The editor of the "Mediæval Town Series" is to be congratulated on having

secured Count Lutzow for the work now before us. He had already made his mark by his works on the History and Literature of Bohemia, and it is evident that the telling the story of Prague has indeed been to him a labour of love. The story of Prague is practically the story of Bohemia, and of this the chapter probably best known to English readers is that which narrates the premature, although far-reaching, attempts at religious and ecclesiastical reformation by John Hus. Count Lutzow's difficulty has been to select and condense from the mass of materials at his disposal, but he has succeeded in setting before us an exceedingly interesting monograph, second to none of its predecessors in the series in literary merit. A word of commendation has to be added for the many illustrations with which the book is embellished.

ASIA.

Sport and Politics under an Eastern Sky. By the Earl of Ronaldshay, F.R.G.S. Edinburgh and London: William Blackwood and Sons, 1902. *Price* 21*s.*

It may seem a work of supererogation to recommend Lord Ronaldshay's book to our readers. Those who heard or read his address to the Society in February last will know what to expect. This book is divided into two parts; the first, dealing with sport in Highest Asia, will compare favourably with any record of sport since the days of the redoubtable Gordon Cumming. If, instead of being a periodical restricted to geography in its widest sense, this magazine were open to general and miscellaneous subjects, then it would be easy to cull from Lord Ronaldshay's account of his exploits a narrative of sport which could not fail to interest and even entrance our readers, for Lord Ronaldshay's experiences in pursuit of big game were as varied as remarkable, and he is quite as ready to narrate his failures as his successes. But for this most fascinating part of the book we must content ourselves with assuring our readers that no better account of sport in Cashmere and Thibet has come within our cognisance. The second part of the book is devoted to a detailed description of his journey from Quetta to the Caspian *vid* Nushki, Sistan, and Meshed, *i.e.* the route he so graphically described in his lecture to us in February last. His object in travelling over this route was to ascertain its present condition, its capabilities, and its prospects, and these he has set forth in the work now before us in much detail. At present the route is practicable only for camels, and this fact is of itself sufficient to account for the comparative smallness at present of the imports and exports. But if, as is expected, a railway is constructed over the route, then the trade both in imports and exports will advance by leaps and bounds. For in Persia, says Lord Ronaldshay, "tea, indigo, leather goods, English cloth, boots and shoes, furniture, all have a ready sale. I brought fifty arm-chairs, belonging to Seth Suleiman, from Quetta with my caravan, and before I left every one had been sold. Among other things he told me that he had ordered 200 ready-made ladies' dresses from Bombay, as well as a large number of ladies' hats and shoes! Imagine the jewel of the harem in a picture-hat and low-cut evening dress!" We suppose Lord Ronaldshay would plead guilty to being a Russophobe, and indeed he gives very good grounds for his distrust of the Russian Empire and policy. But that also is a subject which cannot be discussed here. The book is illustrated with many beautiful photographs, and is equipped with excellent maps, and we have much pleasure in cordially recommending it to our readers.

AFRICA.

Rabeh und das Tschadseegebiet. Von Dr. Max Freiherrn von Oppenheim. With a map. Pp. 199. Berlin: Dietrich Reimer (Ernst Vohsen), 1902.

From a historical point of view this small work is not without interest, as it describes the rapid rise and fall of a man who has been compared with Napoleon. During a long residence in Cairo the author was able to collect a mass of information from the numerous pilgrims from Central Africa that pass through Egypt on their way to Mecca. By this means he is able to fill up many blanks in his hero's life which would otherwise be unknown.

The history is followed by a brief *résumé* of the history of the countries that lie near Lake Chad, Darfur, Wadai, Kanem, etc. In the appendix is a list of caravan routes in the district of Lake Chad and in the Sudan, compiled apparently from native sources.

British Nigeria. By Lieutenant-Colonel A. F. Mockler-Ferryman, F.R.G.S., F.Z.S., Barrister-at-Law. London, Paris, NewYork, and Melbourne: Cassell and Company, Limited, 1902. *Price* 12*s.* 6*d.*

Four years have elapsed since Colonel Mockler-Ferryman published his work on *British West Africa*, and during these years much has happened. We do not refer to the Boer War or to the expeditions to Kumasi, but, to quote Colonel Mockler-Ferryman, "within this short period the Charter of the Royal Niger Company has been revoked, the Crown has assumed the administration of the whole country, the limits of the Niger Coast Protectorate have been considerably extended, new names have been given to the Protectorates, and new administrators appointed. Numerous small military expeditions have taken place, and more important ones are in prospect; missionaries have pushed their way into new fields; science has discovered a reason for the unhealthiness of the coast climate; and civilising influences are gradually but steadily telling on the natives." Under these conditions it was well for Colonel Mockler-Ferryman to revise his work and bring up to date what of it referred to the Niger regions, and now we can recommend this volume to our readers as containing an excellent epitome of what has been ascertained of the early history of the 400,000 square miles known as British Nigeria, and of the origin, languages, customs, and religions of the peoples which inhabit them. We have also a brief but comprehensive exposition of the policy and action of France and Germany during the latter half of last century, with the inevitable mournful indictment of the apathy and short-sightedness of the Home Government. The story of the short-lived administration of the Royal Niger Company finds in Colonel Mockler-Ferryman a sympathetic and skilful advocate; and we have a lucid and interesting account of the states and peoples which now constitute the Niger Coast Protectorates. The present condition of Nigeria receives due attention, and it is one which will require the most enlightened statesmanship of the Colonial Office to solve the difficult problems which are ready to hand. The first of these is slavery, which Colonel Mockler-Ferryman very clearly shows cannot be disposed of by a stroke of the pen. Evidently he deems it indispensable to any progress in Nigeria that the existing communications should be much improved, and that more communications should be made throughout the length and breadth of the land—a measure which would do away with the present necessity for slaves as porters, would facilitate operations to put down slave-raiding and kidnapping, would do much to encourage legitimate trade and commerce, and by enabling the inhabitants to know and have dealings with each other, would soon put an end to tribal jealousies and local difficulties, which are

so serious a hindrance to the development of the country and the spread of civilisation. He admits the insalubrious condition of the West Coast generally, but apparently is not very sanguine that with the destruction of mosquitoes, if such destruction is possible, there will be a cessation of malarial fever, which is accountable for by far the greater part of the deaths and sickness of the European residents. His scathing denunciation of the liquor trade is worthy of profound consideration. On the whole Colonel Mockler-Ferryman takes a cheerful view of the future of Nigeria. It is a region where the motto *festina lente* is appropriate. Firm, although conciliatory, government, the enforcement of peace, the introduction of judicious and timely reforms, here a little and there a little as opportunity presents itself among admittedly barbarous and savage races, the construction of roads and where possible of railways, as quickly as possible, and we may add the minimum of interference by the home authorities with the action of the local authorities, will slowly but surely effect the development of Nigeria, and make it a valuable colony, or rather a dependency, for it can never be colonised by white men in the ordinary sense of the word. This interesting book is embellished with many good photographs and has also a useful map.

The Eldorado of the Ancients. By Dr. Carl Peters. London: C. Arthur Pearson, Ltd., 1902. *Price* 21*s.*

The name of Dr. Carl Peters is not one which sounds pleasantly in English ears, nor for that part of the matter is it much in favour with a good many of his own countrymen. It came into painful notoriety some years ago in connection with allegations of cruelty to natives and misuse of official powers, the upshot of which was that Dr. Peters in 1896, after trial by a "disciplinary court," was condemned and sentenced to be dismissed from the German service. Of course, we have no intention of reopening the "Peters' case," which has all but passed into oblivion; but Dr. Peters, to put himself right with the English and presumably with the German public, restates it from his point of view in his preface to this work, and announces his intention of reopening it, apparently by an action for libel against some unnamed calumniator. We apprehend both the German and English public will be content to await the result of any further investigation.

In the meantime, the very curious, interesting, and learned volume now before us will not fail to attract attention. Studying in a library at Blumenthal on the Weser in 1895, Dr. Peters found an atlas published in 1705-9 by the press of L'Honoré and Chatelaine of Amsterdam, in which he came upon a map of Africa which he afterwards republished, in which the comparative accuracy of the delineation of the courses of the Congo and Zambesi attracted his attention, and he noted the "remarkably complete demarcation of the Portuguese settlements in Central and Southern Africa, above all, of the Portuguese gold-markets and gold-mines south of the Zambesi." This led him to study the time-honoured problem of where was the land of Ophir, from which kings David and Solomon received such immense treasures of gold, etc.; and the volume gives us a description of his travels in Portuguese East Africa and Rhodesia, which, added to a careful and erudite comparison of the works of others who have laboured at the problem, lead him to the triumphant conclusion that he has at last discovered the land of Ophir. It is the country between the lower Zambesi and the Limpopo rivers. He also claims that his researches "tend to establish the fact that the Egyptian 'Punt' expeditions for the yellow metal, copper, frankincense, and many other things were directed to the same regions." It is, of course, impossible for us within the limits of our space to analyse or criticise his arguments. That task will doubtless be

promptly undertaken by one or more of the savants whose theories and conclusions he impugns and contradicts. But the work is interesting in a geographical point of view, as the impressions of a competent and outspoken observer with regard to a country which, although it cannot be said to be unknown, still offers plenty scope for more detailed and keener observation. Dr. Peters makes no secret that he combined business with pleasure. He was prospecting for gold, and whenever he came across auriferous tracts, he registered the full amount of claims for himself and his companions, or possibly for a mining company now in existence or hereafter to be floated. There is nothing to indicate that the work before us is a translation, and if it is not, Dr. Peters is to be congratulated on having a complete mastery of the English language, and a clear, graphic, and incisive style. His observations on the present condition and future prospects of Rhodesia deserve careful consideration by all who are interested in that remarkable colony. In accompanying Dr. Peters in his travels and studies, the reader is assisted by the reproduction of a map dated 1719, "Carte du Royaume du Congo, du Monomotapa, et de la Cafrerie.'

Deux ans chez les Anthropophages et les Sultans du Centre Africain. Par Raymond Colrat de Montrozier. With 24 illustrations and a map. Pp. 326. Paris : Librairie Plon, 1902.

In May 1898 the author with three fellow-countrymen started for the French Congo to explore the country from a commercial point of view. From the coast to Leopoldville in the Congo Free State is now only a matter of two days by rail, and after crossing the river to Brazzaville, which did not strike the author as a very lively or flourishing town, he began his journey on French territory. By steamer he was able to travel in twenty-six days to Bangi on the Ubangi river, just opposite to Zongo on the northern limit of the Belgian possessions. As these steamers have no cabins, travelling by them is neither luxurious nor comfortable. Here navigation ceases and the author had to transfer the thirty tons of merchandise he had with him to native canoes. Owing to numerous rapids, and to a constant torrential rain coupled with violent tropical storms, the onward journey to Mobaye, opposite the Belgian post of Banzyville, was troublesome and uncomfortable in the extreme. Several canoes foundered, and such merchandise as could not be fished up was irretrievably lost. The next points were Wengo and Bangassu on the Mbomu. The latter post is on a marshy, unhealthy site, but it is the only one from which the Sultan of Bangassu can be watched. The officer in command was an old captain totally wanting in energy and prestige. The march of eight days to Raffai was a painful one, and on reaching it the author found the Sultan was only visible at 7 A.M. and from 5 P.M. to 6 P.M. ; all the rest of the twenty-four hours he was dead drunk. At Yapati on the route to Semio six porters deserted. The traveller as a man of action promptly seized six of the chief's wives and retained them as hostages till an equivalent number of porters were substituted. Before he was able to reach Tambura, his furthest point eastwards, just on the watershed between the basins of the Congo and the Nile, provisions ran short and water failed so that the party was in the utmost straits. The porters covered a distance of nearly 200 km. almost without eating. After surmounting this danger, by a lucky accident he succeeded in reaching his destination in rather more than nine months since leaving home. The Sultan of Tambura was unfriendly, would give nothing he was asked for, and declined to supply porters. Here, as elsewhere, ivory was scarce. Altogether the author, during his long and tedious journey, was only

able to obtain about thirty tons of it, and some was lost in passing the numerous rapids that make transport by canoes so costly and dangerous.

On the return journey, in revisiting Brazzaville after an interval of twenty-two months, he found it had grown considerably and now possessed a population of one hundred Europeans. With regard to the French Congo, the author believes that French capitalists have been deceived by false information into investing money in commercial ventures in the country, which, from the outset, were bound to fail. There are other colonies where they could have laid out their money to better advantage. There is no commercial future either for the French Congo or for Central Africa. In the former there are no tropical forests as in the Belgian Congo, consequently there is very little rubber, and ivory is scarce.

A good deal of information about the habits and life of the natives through whom the author passed is given in the course of the narrative ; many of the natives are still cannibals.

AMERICA.

The Great Mountains and Forests of South America. By Paul Fountain. London, New York, and Bombay : Longmans, Green and Co., 1902. *Price* 10*s.* 6*d.*

This book contains a record of very remarkable work in the way of travelling and exploration. From the introduction we learn that the writer has been a cripple since the days of his boyhood, and now, as the result of a second severe accident, he is a mere wreck. His business in life was that of a peddler or "huckster wandering on the outskirts of the settled country, that he might supply the isolated farmers and ranchmen, etc., with the many small necessaries and comforts of their wild life." These are facts which the reader will do well to keep in mind as he turns over these interesting pages. Actuated apparently by a love of nature and adventure, the writer in 1884 proceeded to explore some of the then unknown tributaries of the Amazon, and to wander among the Ecuador Andes and some of the less known parts of Chili and Peru. His companions, he tells us, were thieves and smugglers—outcasts even for South America, and that means much, for, according to our author, "South America does not contain many mammals, especially large ones, but it is the home of the biggest serpents, the biggest rogues, the biggest spiders, the biggest beetles, and the biggest bugs in all creation." Very unfortunately for his readers and for the cause of geography, he was unable to draw up a map of his journey and wanderings, but a perusal of his work shows that under his circumstances this was impossible. As a description of the scenery and some of the natural phenomena of South America, this book leaves little to be desired. Paul Fountain is master of a clear, nervous, vigorous style, free from redundancies and exaggerations, and his capacity to bring a striking scene before his readers may be estimated from the following description of a pass in the Andes. "One of the narrowest which I entered was barely 200 feet wide, with perpendicular, and, in places, overhanging rocks on each side, which could not have been less in height than 3000 or 4000 feet. The light in this terrible place was so dim that a watch could not be read unless it was held close to the eyes ; and, looking upward, but a mere streak of dark blue sky was visible, even this being frequently shut out by overhanging buttresses. There was no motion in the air in this crevasse, and very occasionally a few straws of withered grass could be seen clinging to the face of the rocks many hundreds of feet above us. Under foot was a soft dust, intermingled with masses of scoriæ that made walking laborious, the feet sinking ankle deep at every step. . . . I

estimate the length of this crack at about five miles. Near the middle it widened rather abruptly to 200 yards ; but just beyond the rocks closed together, so that there was scarcely room for us to push through. Here the rocks bulged over frightfully, as if about to cave in and crush us, and the way became a narrow tunnel, dark as a mine. The rocks overhead probably met, leaning together, but it was too dark for us to see this; and it was not till a torch had been lighted that we could proceed. Vast masses of shattered rocks showed that falls often occurred here, and the passage was almost blocked by the rubble and masses of scoriæ, much of which was so rotten that it went to dust under our feet ; and this dust, which was so fine that it felt soft as feathers, rose in suffocating clouds as we passed through it, leaving a burnt sulphurous odour. To all appearance no drop of rain ever reached the bottom of this chasm. Everything was as dry as tinder and had a scorched look. Nothing of life could be found, though I made diligent search for such. . . . The sensation of being thus closely buried within the bowels of the mountains was oppressive, almost terrifying. I felt as if in a grave or a trap, and in spite of my efforts to shake off all morbid feelings, the idea would continually haunt me : 'what if a fall of rock should suddenly take place behind you : you will be buried in a living grave.' That such falls did take place was evident, for we had climbed with difficulty over the shattered rock, and the thought was terrifying, and I involuntarily glanced back every now and then in the half-formed fear of witnessing such a fall. . . . The rent went quite through the mountain, the opposite opening overlooking the immense plain of the Amazonas."

Those who are acquainted with our author's previous work, *i.e. Deserts and Forests of North America*, will not need to be told that interesting and valuable information and notes regarding the flora and fauna of the tracts visited are a special feature of this work. The author is a quick and keen observer in all directions, and he has the courage of his opinions and is ready to break a spear with the champions of "protective colouring" in birds and animals, or to challenge current theories as to the food of vampires, or the length and habits of serpents. He has nothing to say in favour of the Indian tribes he met, with the exception of the Araucanians of Chili; he denounces in unmeasured language nearly all the Spaniards, Portuguese, and half-breeds with whom he came in contact, but his severest condemnation is reserved for the priests and women ; and if half of what he alleges of them is true, they certainly deserve universal reprobation. On the other hand, he has a kindly word for the derelicts of society with whom he was repeatedly associated, and with whom in his comparatively helpless condition he had no difficulty in making his way. He won their confidence, and with their guidance and help he was able to go where no ordinary traveller, and not even a government official, would dare to venture. Among the Ecuador Andes he found auriferous quartz, which his experience in California induced him to estimate as carrying from nine to eleven ounces of gold to the ton of ore, and also coal seams about 15,000 feet above sea-level. West of Xiromena he found diamonds, but examination in Europe pronounced them of bad colour and of no great value. Both in the Purus swamps and in the Ecuador Andes he came upon stone huts and the remains of villages apparently the work of aborigines, the entrances never exceeding thirty inches in height. But enough has been said to indicate that this book is one of unusual interest, and we gladly recommend it as such to all our readers.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Britain at Work. A Pictorial Description of our National Industries, written by Popular Authors, and containing nearly 500 Illustrations. London : Cassell and Co., 1902. Pp. viii + 334. *Price* 12*s.*

Northern Italy. Handbook for Travellers. By Karl Baedeker. 30 maps, 39 plans. Leipsic, 1903. 12th edition. *Price* 8 *marks.*

Highways and Byways in London. By Mrs. E. T. Cook. With illustrations by Hugh Thomson and Frederick L. Griggs. London : Macmillan and Co., 1902. Pp. xiii + 480. Extra Crown 8vo. *Price* 6*s.*

Across Coveted Lands : or a Journey from Flushing to Calcutta Overland. With over 150 illustrations from photographs and sketches. By A. H. Savage Landor. London : Macmillan and Co., 1902. Two vols. Vol. I. vii + 461 ; Vol. II. viii + 459. 8vo. *Price* 30*s. net.*

The Administration of Dependencies. A Study of the Evolution of the Federal Empire, with special reference to American Colonial Problems. By A. H. Snow. London : G. P. Putnam Sons, 1902. Pp. vi + 618. 8vo. *Price* 15*s. net.*

Forests of Upper India and their Inhabitants. By T. W. Webber, late Forest Surveyor for the N.-W. Provinces. With maps. London : Edward Arnold, 1902. Pp. xiii + 334. Demy 8vo. *Price* 12*s.* 6*d. net.*

Through Hidden Shensi. By Francis H. Nichols. Profusely illustrated. London : George Newnes and Co., 1902. Pp. xxxi + 333. Demy 8vo. *Price* 12*s.* 6*d. net.*

Wayfarers in Italy. By Katherine Hooker. Illustrated. London : George Newnes and Co., 1902. 8vo. *Price* 12*s.* 6*d. net.*

Delhi Past and Present. By H. C. Fanshaw, C.S.I., late Bengal Civil Service. With maps and illustrations. London : John Murray, 1902. Pp. xiii + 337. Demy 8vo. *Price* 18*s. net.*

Across Iceland. By Wm. Bisiker. With 50 illustrations and maps. London : Edward Arnold, 1902. Pp. xi + 236. Demy 8vo. *Price* 14*s. net.*

Travels in North and Central China. By John Grant Birch. Illustrated by numerous reproductions taken by the author. London : Hurst and Blackett, 1902. Pp. xvi + 379. Demy 8vo. *Price* 10*s.* 6*d. net.*

China and the Chinese. By Herbert Allen Giles, LL.D. London and New York : Macmillan and Co., 1902. Pp. ix + 229. 8vo.

À Madagascar. Par Dr. D'Anfreville de la Salle. Paris : Plon, Nourrit et Cie, 1902. Pp. 323. *Price* 4 *francs.*

Das Moderne Italien. Geschichte der letzten 150 Jahre bis zum Ende des Neunzehnten Jahrhunderts, von Pietro Orfi. Leipzic : Verlag von B. G. Teubner, 1902. Pp. x + 380. 8vo. 5·60 *marks.*

Mon Tour du Monde. Les Indes, la Chine, le Japon par La Ctesse Du Bourg de Bozas. Ouvrage orné de 165 gravures d'après les photographies et les documents rapportés par l'auteur et d'une carte. Paris : Plon, Nourrit et Cie, 1903. Pp. vi + 524. 8vo. *Prix* 10 *francs.*

Das Sonnevendgebirge im Unterinnthal. Ein Typus Alpinen Gebirgsbaues, von Dr. Franz Wähner. Erster Theil mit 96 Abbildungen, 19 Lichtdrucktafeln und einer Geologischen Uebersichtskarte. Leipzig und Wien : Herr Franz Deuticke, 1903. Pp. xii + 356. 35 *marks.*

Nueva Geografia de Colombia. Escrita por Regiones Naturales por F. J. Vergaray Velasca. Tomo i. Geografia General Imprentade Vapor, Bogota, 1902. Pp. 127 + 1004.

Also the following Annuals, etc. :—

Official Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. Nineteenth annual issue. London : Chas. Griffin and Co., Ltd., 1902. 8vo. *Price 7s. 6d.*

Washington Geological Survey. Henry Landes, State Geologist. Volume i. Annual Report for 1901. Olympia : Washington Geological Survey, 1902.

The Nile Reservoir Dam at Assuan, and After. By W. Willcocks. Cairo, 1902. Pamphlet, 14 pp.

The following have been presented to the Library of the Society :—

Distribution annuelle des Orages à la Surface du Globe terrestre. Par A. Klosovsky. Pamphlet, with map.

Vie Physique de Notre Planète devant les lumières de la Science Contemporaine. Par A. Klosovosky. Odessa, 1902. Presented by the Author.

Essai de Chronologie des Variations Glaciaires, and *Revue de Glaciologie.* Pamphlets par M. Ch. Rabot. Geneva and Macon, 1902. Presented by the Author.

Maps, Their Uses and Constructions. A short popular treatise on the advantages and defects of maps on various projections, followed by an outline of the principles involved in their construction. By G. James Morrison. Second edition. Revised and enlarged. London : W. E. Stanford and Co., 1902. Pp. xii + 152. Presented by the author.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st October 1902 :—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas. Price 3s. each). *Forfarshire.*—Sheets XIX. 8, 12 ; XXVI. 4 ; XXXIII. 8 ; XXXVIII. 3 ; XXXIX. 3, 6, 10 ; XLV. 11, 14, 15 ; L. 14, 16 ; LI. 2, 5, 9, 10, 13 ; LIII. 8. *Orkney.*—Sheets CVI. 3, 4, 6, 7, 12, 15, 16 ; CVII. 1, 2, 3, 4, 5, 7, 9, 12, 14, 16 ; CVIII. 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15 ; CXIII. 2 ; (CXIII. 14 and CXIX. 2).

Note.—There is no coloured edition of these sheets, and the revised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Zetland.*—Sheets 25, 36, 37, 38, 41, 52, 56 (Price 2s. 6d. each). Sheets 32, 34, 35, 39, 40, 49, 50 (Price 2s. each).

Quarter-Sheets, with Contours :—*Aberdeenshire.*—7 NW. ; 11 NE. ; 16 SW. ; 26 NW. (Price 1s. each). *Forfarshire.*—30 NE. (Price 1s.).

One-inch Map, New Series (Revised), with hills, printed in colour. Scarp, Sheet 98 ; Tarbut, Sheet 99 ; Valtos, Sheet 104 ; Portnaguiran, Sheet 106 ; Butt of Lewis, Sheet 111 ; Cellar Head, Sheet 112 (Price 1s. 6d. each).

One-inch Parish Indexes, printed in colours in two forms, one showing the 1:2500 scale maps, and the other the six-inch sheets. Sheet 122 (Price 1s. 6d.). Printed in colours in two forms, one showing the 1:2500 scale maps, and the other the six-inch quarter-sheets. Sheets 56, 76, 77, 86 (Price 1s. 6d. each).

Four-Mile Maps, by Sheets, with water printed in colour. Sheets 7, 8, 11, 13; Sheet 15 (filled in with England, part of Sheet 2) (Price 1s. each).

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 29th November 1902:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas, Price 3s. each). *Forfarshire.*—Sheets XIX. 16; XXVI. 8, 12, 16; XXXIII. 4, 12; XXXIX. 1; XLV. 7, 10; L. 13; LI. 3, 7, 11, 14, 15; LIII. 3, 12; LIV. 8; LV. 2, 8, 4, 7. *Orkney.*—Sheets CVI. 10, 11; CVII. 13; CIX. 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CX. 9, 13; CXII. 3; CXIII. 1, 3, 5; CXIV. 3, 4, 7, 8, 12; CXV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; CXVI. 1, 10; CXIX. 6.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Zetland.*—Sheets 29, 51 (53 and 53A) (Price 2s. 6d. each).

Quarter Sheets, with Contours:—*Aberdeenshire.*—3 SW.; 5 SW.; 6 NE., 6 SW., 6 SE.; 7 NE.; 8 NW., 8 NE., 8 SW.; 61 NE.; 81 SE. (Price 1s. each). *Perthshire.*—43 SE. (Price 1s.).

General Remarks:—*Lanarkshire* (Revised).—Six-inch scale.—Sheet 45 NE. To be inserted on page 14 of Catalogue.

One-Inch Maps (New Series, Revised). Engraved, with hills. Sheets 75, 114 (Price 1s. each). Printed in colours and folded in cover or flat in sheets.—Liverpool and its Environs, comprising Sheet 96 and part of Sheet 83 (Price 1s. 6d). Skegness and its Environs, comprising Sheet 116 and part of Sheet 129; Wrexham and its Environs, Sheet 121; Welshpool and its Environs, Sheet 151; Shrewsbury and its Environs, Sheet 152; Llanidloes and its Environs, Sheet 164 (Price 1s. each).

Towns and their Environs, flat in sheets or folded in cover, with roads printed in colour.—Leicester, comprising Sheet 156 and parts of Sheets 141, 142, 155, 169, 170.

Note.—The price of this map has been raised from 1s. 3d. to 1s. 6d.

One-Inch Parish Indexes, printed in colours in two forms, one showing the 1:2500 scale maps and the other the Six-inch Quarter-Sheets.—Sheets 139, 150, 233, 235, 313, 329 (Price 1s. each).

ADMIRALTY CHART. Loch Sunart. 1902. Scale 1 : 24,315. *Price 2s. 6d.*
Hydrographic Office, London.

LONDON DISTRICT. Bartholomew's Cyclists' Road Map. Scale half an inch to a mile. In two sections—Northern District and Southern District. *Mounted on cloth, price 1s. 6d. each.*
John Bartholomew and Co., Edinburgh.

AFRICA.

CONGO. Carte du Bas-Congo à l'échelle du 1:100,000 en 15 feuilles. Dressées par H. Droogmans, Secrétaire-Général du Département des Finances de l'État Indépendant du Congo. Feuilles 4 et 8. 1902.

JUBA RIVER. War Office Map of Africa. Sheet 88. Scale 1 : 1,000,000 or about 16 miles to an inch. 1902. *Price 2s.*
Intelligence Division, War Office.

SOMALILAND. Map of British Somali Coast Protectorate. Scale 1 : 1,000,000. December 3, 1902. *Price* 5*s.*

Edward Stanford, London.

This is a new map issued in December, but it does not include the results of recent surveys shown in the War Office Map published some months ago.

AMERICA.

UNITED STATES. Rand, M'Nally and Co.'s Indexed County and Township Pocket Maps. Louisiana, Maine, Massachusetts, Minnesota. *Price* 25 *cents each.* Vest Pocket Maps of Michigan Northern and Michigan Southern. 1902. *Price* 15 *cents each.*

Rand, M'Nally and Co., Chicago and New York.

UNITED STATES. Topographic Sheets, on Scales of 1 : 62,500, or about one mile to an inch, and 1 : 125,000, or about two miles to an inch. *Price* 5 *cents each sheet.* (The figures indicate the number of sheets received for each State). Arkansas, 4 ; California, 6 ; Georgia, 1 ; Indian Territory, 3 ; Iowa, 2 ; Maryland, 7 ; Minnesota, 1 ; Missouri, 1 ; Montana, 3 ; New Jersey, 1 ; New York, 5 ; Tennessee, 3 ; Utah, 1 ; Wisconsin, 3.

United States Geological Survey, Washington, D.C.

NEW ATLASES.

ATLAS UNIVERSEL DE GÉOGRAPHIE. Commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. No. 3, Mappemonde. No. 19, Espagne et Portugal en 4 feuilles. Feuille Sud-ouest.

Librairie Hachette et Cie., Paris.

These maps are wonderful specimens of condensation and minute cartography ; in this respect they are unequalled by any other atlas.

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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ASCENT OF AN ANDEAN VOLCANO IN ERUPTION.

By R. Blake White, C.E.

The Puracé volcano lies about sixteen and a half miles to the ESE. of the city of Popayan, the capital of the Department of Cauca in the Republic of Colombia. It is one of the giants of the Central Andes Cordillera, its height above sea-level being 15,070 feet. The perpetual snow-line is at 14,700 feet, not high enough to form glaciers, but sufficiently elevated to maintain an average depth of three feet of snow over the upper portion of the mountain.

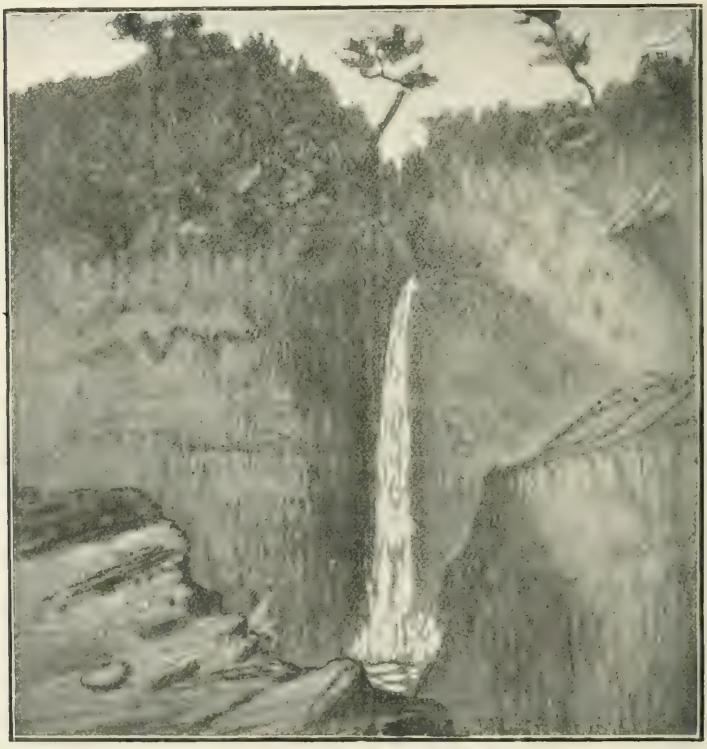
Since the time of the Spanish Conquest no violent eruption had taken place up to 1869, although the volcano had never been extinct. Numerous sulphur holes, "azufrales," and hot springs existed, and a river called the "Vinagre," or Vinegar river, took its rise at the NW. foot of the great cone. The water of this river contained on an average 0·11 per cent. of sulphuric acid and 0·09 of hydrochloric (analysis by Boussingault). It is so acid that the spray from a pretty waterfall called San Antonio, near the village of Puracé (see Sketch), causes one's eyes and skin to smart so severely as to oblige one to keep well away from it.

In 1849 an explosion took place which is said to have blown away the upper part of the cone, lowered the volcano considerably, and widened the crater.

In 1868 the crater was nearly circular and measured 1800 feet in diameter, and its depth was about 350 feet. At the bottom was a lake of hot water from which steam rose. The inner slopes were generally regular, broken here and there by jutting masses of lava rock. When I stood upon its brink in that year, there did not seem to be anything very fearful about it. Many Scotch tarns look much the same.

This brief description will suffice for my narrative. Minor features, such as sulphur caves, conveniences for boiling eggs and shaving, gas escapes noxious to dogs, and other such chronic manifestations of volcano restlessness, need no notice: they are much the same in all volcanoes.

A number of streams descend from the SWW. and NW. flanks of the mountain and form the river Cauca, which, after running for some miles in a deep valley with a northerly direction, turns to the west and then to the WSW., passing about a mile from Popayan. Thus the Cauca



Cascade of San Antonio, Puracé.

Cañon lies between the city and the volcano, as well as an intervening mountain ridge, which is 1700 feet higher than the city. No lava stream, therefore, can ever affect Popayan.

At 1.20 A.M. on October 4, 1869, the inhabitants of this city were awakened by the noise of an awful explosion, accompanied by a severe earth shock. Every one rushed into the streets, whence a view of the volcano could be obtained. The crater was in a blaze of flame, and naturally a panic ensued, like those which have recently taken place in Fort de France. I resided in a house on a street corner from which the Puracé could be seen, and the Alcalde called me out in such piteous

tones that I had to go out to calm him. A roaring mass of flame of the whole width of the crater rose to a height of over five thousand feet in the air. Above the flame a black column of smoke continued to rise in a dense mass. This was illuminated by incessant forked lightning with gorgeous colouring, and still higher up a huge grey and black cloud rapidly increasing in size laterally was spreading out like a pall. I took the height of this cloud with my theodolite, which I levelled by the light of the volcano, and it gave a vertical angle of 22°, which on a distance of sixteen and a half miles made its height to be close on seven miles. I tried to get the people to return to their houses, telling them that we should have a shower of ashes before morning, but it was of no use—they were too scared. Hundreds fled to the plain near the river Cauca, where in less than two hours they were terrified by the tremendous flood which came down the river, which has a fall in its main channel between the foot of the volcano and Popayan of more than two thousand feet in fifteen miles. The flood was caused by the almost instantaneous melting of at least eight million cubic feet of snow that lay on the mountain, and the torrents of water swept down more millions of the loose volcanic soil forming the slopes and base of the cone, together with the enormous quantity of material ejected by the explosion. A deluge of mud was thus formed which swept along with it rocks of fifty and a hundred tons weight. The mud was intensely acid, and killed all the fish in the river Cauca and the neighbouring lagoons over a distance of three hundred miles or more. My friend the Alcalde, like all the rest of the people, camped out in the street with all his family, and as he would not listen to my advice, I served him and his with a drink of good brandy all round, a form of counsel that he found very acceptable, and then after taking a doze of the same sedative I retired to my house.

At 4 A.M. I was roused by a great knocking, and had to hurry out to admit the governor of the state and his secretaries, who were accompanied by a crowd of people. They came to beg me in the name of humanity to go to the volcano and report as to the danger that might still threaten the neighbourhood. They said I was the only man in Popayan who was competent to form an opinion; which was true, for as the Spanish proverb says, "In the land of the blind the one-eyed man is king." So, recognising the necessity, and not giving so much thought to the risks as I did to the interest of the phenomena I should see, I said, "Voy."

At 5 o'clock all was ready. As companions I had two peones, a volunteer named Theodor Boeving, a German (since dead), and a government employé to act as purser and commissary, named Rafael Mosquera, who is still living. Our horses were particularly good. We crossed the Cauca to its right bank by the Spanish stone bridge, which had almost miraculously resisted the flood, and at 7 we got a fine view of the volcano from Pisojé. A huge column of steam with flames rushed up from the crater with great velocity to a height of a mile or more, where it formed billows like dense cumuli, which rose and rose, pile upon pile, impelled by the mighty blast, until at an elevation of at least three miles they spread out right and left like the crown of a great tree. There seemed

to be little smoke and no ash, so that things looked promising. As to the ash that had fallen it covered the ground in Popayan to the depth of half an inch, and was deeper as we neared the volcano. This is no great amount for a volcanic shower, but far larger quantities fell to the south and south-east, carried by the wind. Near the volcano the rain of stones was very heavy, and in the Hacienda of Coconuco it killed all the sheep.

About eleven we arrived at the valley of the river Anambio, which is formed by the streams coming from the W. and NW. flanks of the Puracé. On either side of the river there were flats sown with anise. We found these flats covered with mud with no trace of a road, so we sent in a man with a pole to sound. The mud turned out to be from 3 feet to 3½ feet deep in the lowest parts. So we unbridled the horses, hitched up the stirrups, took off our clothes, and started in to wade with the aid of good sticks. It was hard work, but we struggled merrily through some three hundred yards of sludge and got to the river. The water was hot and very acid, and we forded it in a hurry, and then floundered through another hundred yards of mud on the other bank. So far we had found the mud muddy and evil smelling, which was quite correct, but we did not know that it could sting. There was a hot sun, the mud began to dry quickly, and we instantly felt an awful smarting which was clearly caused by a liberal percentage of sulphuric acid which was present in the mud. And where to wash? Five hundred yards away there was a stream; we did not hesitate—we resolved, and we ran. There was no order in the going, and it was not respectable nor pilgrimlike. We had an object, and a very pressing one. When we had washed, and we did not hurry over that, we found that we were burned lobster-colour from the waist down, so we got out our soap and had another good wash, after which we resumed our journey. We felt more respect for the Puracé, and some curiosity as to further diversions which the volcano might have in stock.

We arrived at the village of Puracé at 2 P.M. and were enthusiastically welcomed. The people were very frightened, and no one had left the place. The shower of stones had been very heavy, but the stones were not big, and only a few people had been bruised. The volcano was keeping up a dull roaring, with a heavy explosion every fifteen or twenty seconds, which caused a jerkiness in the tale of terror that the Alcalde gave us, and the irrelevant and copious use of a famed Spanish interjection. However, our pious mission was appreciated, and most of the folk believed that I would be able to quiet the mountain, as I had a good acquaintance with it, and likely enough had looked into the devil's own book up there and found out his secrets. So they flew around and baked bread and biscuit of good native flour, killed sheep, dug potatoes and "arracachas," and gathered in a good store of miscellaneous provisions.

Next day at 7 A.M. we set off. The mountain is only six miles distant and the road fairly good, but we took three hours to reach the camping-ground, as we had to collect firewood and gather dry grass for bedding and thatch. We had oxen and ponies—both dwarfed like Shetlands—accustomed to go to the mountain for snow to take to

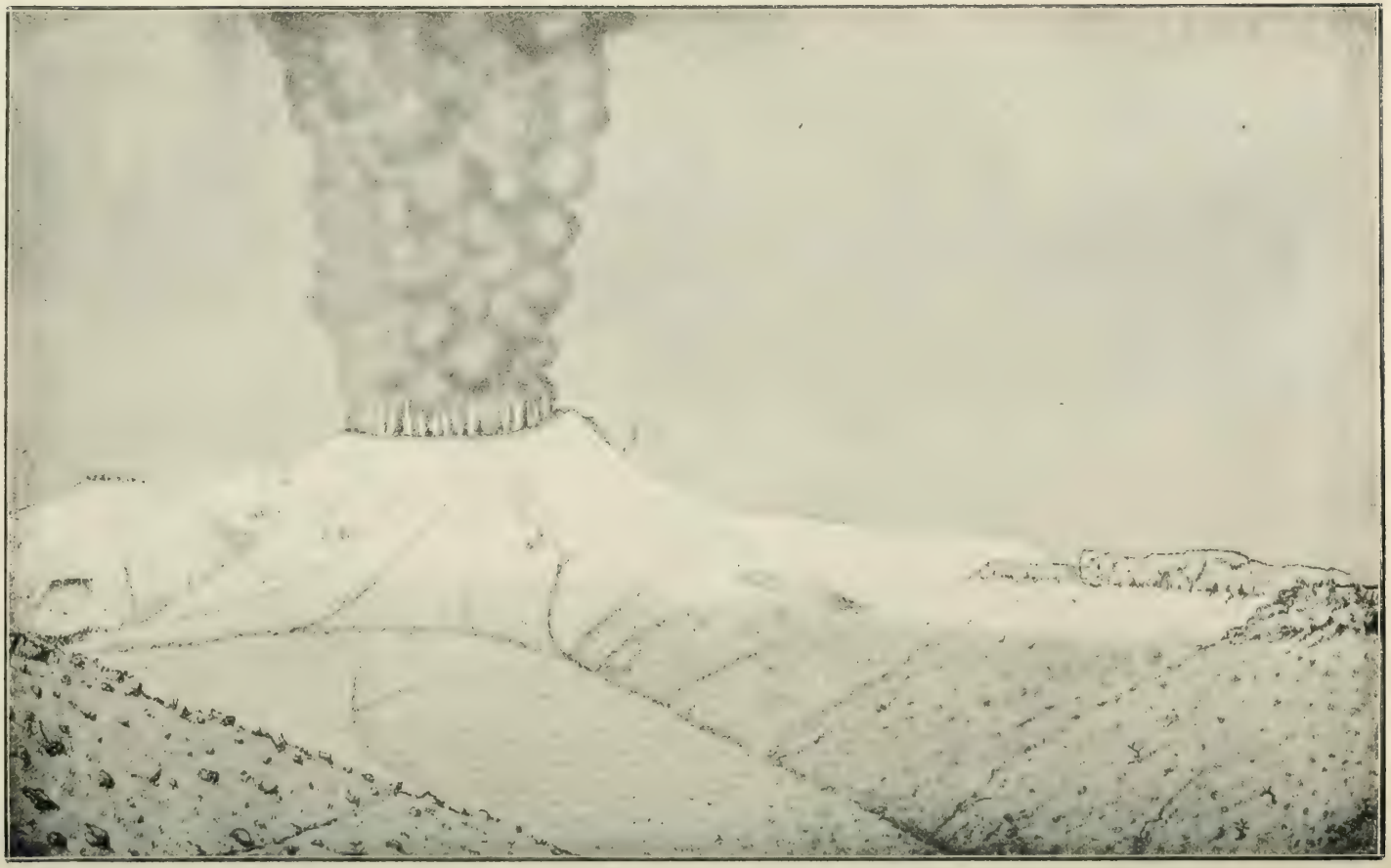
Popayan, and some fifteen hardy and smart Indians selected by the headman, and threatened with a severe hiding if they did not behave well. Only their own chief can so treat them, and he is subservient to the Alcalde. I selected my old camp of the year before. Its height above sea-level was 13,050 feet and the temperature ranged from 30° F. at dawn to 55° in the hottest part of the day. The spot was sheltered from the wind and there was a spring of good water, and also a hot spring of water, pure enough for washing and cooking. A large stream coming from the west face of the mountain fell from a lava ledge about 30 yards away in a fine cascade of 100 feet in height, and dashed away down a precipitous ravine.

To the east the ground rose in a sloping plain some 500 yards wide and 800 in length from north to south. This plain is called "Los Cenizales," or Ash fields, and at its eastern end was the foot proper of the cone of the Puracé. (See Sketch.) This has a slope of about 40° up to the edge of the crater, 2000 feet in vertical height above the camp, and distant about 4200 feet in a straight line, or say two-thirds of a mile. We had therefore a clear view of the whole west face of the cone.

Before evening we were nicely settled. A tent was pitched for the men, and a hut built of grass sods—the last of the vegetation—and thatched with hay, for my companions and myself. The Indians dug out a fireplace and oven for cooking in a handy bank after their own fashion. When we had dined and night fell the spectacle began. The fireworks were impressive enough in the daytime, but after dark they were marvellous, and, I must say, appalling both to the sight and to the ear.

The whole crater was ablaze: roaring flames shot up from it 1000 feet; they rushed up with fierce violence; they did not "lick" or "swirl" as commonplace flames do, but looked just like what they were —a mighty gas jet under enormous pressure. Above the flames a column of steam, white, red, orange, yellow, blue, green, of all colours, illuminated by the glare, followed the mad upward rush of the flames for another 2000 feet at least, and then began to break in billowy masses, which seemed to be capped by a spreading black cloud. Perhaps it was only black by contrast, for it was the seat of a most wonderful display of lightning, forked, zigzag, and flash, which did not cease for an instant. Possibly the roar of the volcano prevented one's hearing thunder—at any rate it was not distinguishable. I supposed the electricity to be generated by the steam, remembering the kettle spout experiment of our first lessons in physics.

The earth shook with a continuous tremor, caused clearly by the rushing forth of the mighty jet of gas and steam, but altogether I felt pretty sure that we ran no great danger where we were. So as we were feeling the cold a good deal, and at these elevations 32 degrees is no joke, we went to bed about 8 o'clock. Hardly were we settled when we heard a new kind of roaring up in the mountain. It quickly became louder, seemed to be nearer and accentuated by a banging or thumping sound. In five minutes the roar became terrifying: it was



The Volcano of Puracé in Eruption, October 4, 1869.

clear that an avalanche or deluge of some kind was sweeping down from the mountain. We all got up: the Indians ran away to some high ground. Down came the flood, for it was a flood, and with a deafening roar it hurled itself over the fall and into the ravine close by. The earth shook as the huge rocks crashed to the bottom and crunched and pounded each other in the fall. It was over and gone in two minutes. After (with some trouble) calming the fears of the Indians, we went to bed again, and I thought out the why of this strange occurrence, which might become chronic and vexatious. My explanation of it was that the low night temperature condensed the great cloud of steam rising from the crater, and produced a heavy fall of snow. This would melt rapidly on the heated cone, and the water, gathering up unmelted snow, loose earth, and rocks, would form a mud torrent of great volume and mighty force. And so it was, but my explanation, although it allayed our fears, did not save us from the hourly annoyance all through the night of one of those floods roaring and crashing and banging by our ranch. The ravine was our safeguard, as I had calculated it would also be in the event of a flow of carbonic acid gas rolling down from the mountain, a danger of which I had had some experience.

Morning came and found us all right and ready to plan the ascent of the cone. By the bye, I got very little sleep that night owing to the earth tremors, which were most uncomfortably magnified by my air-pillow. This note may serve some other visitor to volcanic spectacles. Hay was good enough for me subsequently as a pillow. There was only one route by which we could reach the crater, and this lay up a ridge to the north-west of the cone. This ridge was an ancient lava stream, and not half so steep as the sides of the cone. Some 500 yards below the summit it made a saddle with a large mass of lava rock on the north. This point is called the "Horqueta," and is seen to the left of the Sketch. To reach it the way lay up the ash-fields to the foot of the cone, and then diagonally across its face, gradually ascending and passing by the Solfataras shown in Sketch. There was a path practicable for ponies, but it had been wiped out by the eruption, and now the way lay over loose ash and stones. But a north-west breeze was lacking: without it the straying and circling swirls of vapour and gas would render the ascent impossible. The wind was all the other way, so I employed the day in studying what evidence I could find of the character of the eruption. Little ash had fallen, for, as already stated, the bulk of it had been blown to the south and south-east. But a great quantity of rocks had fallen. Some were enormous, and had buried themselves in the soft ash, where they lay hidden in steaming pits of mud. Others had struck hard ground, and their fragments were lying around, and others, smaller, had not penetrated the ground much. Some of these I dug up and examined. Many were still hot, and some big ones were hot enough to light one's cigar. Nevertheless I found no bombs nor signs of rock fusion, but only rarely a little superficial glaze, such as might be produced in an instant by a burst of flame.

Next day matters were worse. There was little wind, and the smoke hung low. The sulphurous fumes reached us in our camp, and

caused us some discomfort, especially when eating, for the food tasted of sulphur and "French" eggs.

The next morning broke brightly with a strong breeze from the north-west, and the ascent was clear. We started, Boeving, Mosquera, myself, and two picked Indians. We carried a shovel, and as provision some "panela," a crude sugar, which as a heat producer is the best food for such a trip at high altitudes. I put on (and I mention it for a reason), highland fashion, a grand Paisley shepherd's plaid, which had braved the snow of Ben Nevis, and was good enough for the Andes.

Walking up the ash-fields was heavy owing to the soft ash, and we had some difficulty in crossing a ravine at the foot of the cone. The floods, however, had left little else but stone on its steep banks, and we got over safely. The Solfataras were blowing furiously, and the sulphur fumes were very strong. The ground was very hot, and when I stopped for a moment to peep into one of the gorgeous, golden, sulphur-lined crevices I thought I had burned my boots. We hurried past, and followed the diagonal ascent towards the Horqueta. Here walking was easier as the water from the melting snow above had swept away the loose material and left firm ground. Half way up Boeving was overcome and seized with sickness, so we tucked him under the lee of a big stone, and kept on. When we reached the Horqueta (14,130 feet) Mosquera began to complain, but I cheered him up. The ridge leading up to the crater was good walking though steep (20 degrees), and there was some snow—4 to 6 inches—owing to the core of the ridge being of rock, and not having been heated like the rest of the cone. After going up another 200 yards Mosquera declared he could go no further, and that if I did not let him turn back, he would die, and never see his mother again. So I said go, and he went. So far the breeze had kept off the smoke, but now it began to flicker, and wreaths of smoke whirled down and enveloped us. It was awfully choking. I covered my mouth and nose with a handkerchief, and the Indians used their shirt tails. When an extra strong whiff came we threw ourselves down and scooped up a little barrier of snow before our faces. We could only struggle up 20 or 30 yards at a spurt. At last I thought I should have to give in. I was half asphyxiated, and my eyes were smarting badly. Lying on the ground I felt a strong breeze, and peeping up through my fingers I saw some jutting stones. I guessed it was the edge of the crater, so I took a good breath of fresh air, and made a rush for it. Sure enough it was the crater's edge, and I dropped sharp on my hands and knees, for I had no wish to fall into it. I cannot adequately describe what I saw. Such an immensity of flame is beyond description. The noise must have been awful, but I did not hear it, for I was too busy looking. I concentrated all my faculties in the endeavour to see the *how* of that fearful thing, and this is what I saw.

The bottom of the crater looked dark, a dull red. The rush of gas and steam was invisible, there was no condensation, no flame. All the fire was aloft. Two-thirds of the way up from the apparent bottom the enormous violence of flame leapt skywards in a furious rush. From that point, the centre of combustion, the flames darted *downwards*. How

they flashed down, how they recoiled, how the mighty tongues of fire seemed to aim at penetrating the awesome chasm which they could not reach, and how splendid were their colours! All the colours of the spectrum were visible. As a blowpipe expert, I thought, "There's copper, sodium, strontium, potassium, magnesium, chromium, nickel, everything that colours a flame!" The flashing and darting of the flames was something like what one sees at times in the aurora borealis.

I had seen what there was to see; so I ran to the Indians, who were still lying down, and kicking them and shouting that if they didn't go up no one would believe me, I induced them to run up and take a look. They turned terrorstricken and tore down; I followed suit, and we did not stop until we reached the Horqueta. Here we hunted up some clean snow in the clefts of the rock, and fell to eating it with "panela" to clear our throats. We sniffed the snow up our nostrils to allay the smarting, and after a rest we descended to the camp. Here we stayed the rest of the day, while the Indians went down to the village to bring up the horses. Next morning on reaching for the handkerchief that had served me as a respirator the previous day, and which I had hung up to dry, it fell to shreds, completely burned by the acid gas. The black check in the ends of my plaid had turned yellow, though the fabric was not hurt. I had a nasty pricking away down in my left lung, and now, thirty-three years after this trip, every doctor that examines me says I have a little patch of lung dried up and adhering to the pleura. I only mention this as a warning to volcano explorers not to underestimate the corrosive power of volcanic gas.

On my return to Popayan I made a report to the Government, which was published in the official gazettes of Popayan and Bogotá. In the report I gave my opinion that the eruption was one of gas and steam only, and had free vent, and that so long as no lava was formed, there was no practical danger to the districts around the volcano.

After the explosion it was seen that a huge piece of the summit of the cone on its west face was wanting, as my sketch shows. I roughly estimated its cubic contents at eight million yards. This great lump did not slide down outside, and must therefore have fallen *into* the crater, but as the catastrophe happened at night, it is not known whether the slide was caused by the first tremors of the eruption, or whether the mass fell into the throat of the volcano, choking it, and thus inducing the outburst. What is clear is that this great mass was blown clear out of the volcano by a force representing thousands of millions of horse-power.

The Puracé is now, I believe, in active eruption, and forming lava. It explodes frequently, and rains much ash containing olivine and augite, which I take to be evidence of the presence of melted rock.

The Puracé may be easily visited, and a scientist would find the trip both instructive and interesting.

THE PHYSICAL GEOGRAPHY AND GEOLOGY OF AUSTRALIA.[1]

By J. P. Thomson.

Australia, as a whole, is probably one of the oldest of all the land masses on the face of the globe. Even in the far back and vastly remote ages of antiquity, when numerous isolated nuclei of future land areas were formed, the evolution of Australia was greatly in advance of that of many other continents. There seems no reason whatever to doubt that most of the continent belongs to an age anterior to that of the greater part of Siberia, Europe, Asia, and Africa, and of the West Coast of America. The extensive areas occupied by plutonic and metamorphic rocks along the great border rim of the territory, and the occurrence of the oldest fossiliferous deposits, overlying these rocks in many places, furnish weighty evidence of a far back history.

The whole of the eastern side and a portion of the south side of the continent are occupied by mountain ranges and valleys, representing the anticlinal and synclinal folds of the earth's crust. The average height of these dominant areas of elevation is about 2000 feet above sea-level. The north side is slightly less elevated, and the western one, consisting of an immense plateau, seldom exceeds 1500 feet above the sea. The geological structure of these regions, although geographically widely separated, does not vary in any material respect, consisting chiefly as it does of a series of ancient stratified rocks of Palæozoic age, the older members of which are more or less metamorphosed. There also occur within these areas granitic and syenitic rocks and various crystalline schistose rocks, as well as bedded and intrusive basic igneous ones, of different ages. The fossiliferous formations associated with these ancient rocks are Palæozoic, Mesozoic, Tertiary, Post-Tertiary, and Recent. The beds in which the fossils occur are very extensive, and bear local designations by which they are distinguished. The granite rocks are very largely developed, and may, in point of fact, be regarded as the very foundation of the areas under consideration. On the eastern side of the continent the sub-aerial weathering of the rocks is fully apparent, but nowhere has the process of denudation been more active than along the north-eastern coastal region adjacent to the Great Barrier Reef, where the former tableland character of the country has been materially modified. Metaphorically it may be fairly stated that the central portion of the continent is almost completely surrounded by a chain of gold with pendants composed of precious gems and of the valuable metals for which Australia is famous. These occur in the granites and other ancient rocks throughout the entire regions under review. There are, besides these older minerals, very extensive coal-beds in basins overlying the

[1] The following paper forms part of an address delivered before the Royal Geographical Society of Australasia, Queensland, on Sept. 22, 1902. It is one of a series of papers on the same subject written by the author.

older rocks unconformably. The coal measures, which belong to the primary and secondary periods, are largely developed in New South Wales, Victoria, and Queensland. The Desert Sandstone, or upper Cretaceous formation which overlies the coal-beds, must at one time have covered a very great portion of the continent. Being of exceedingly soft texture it has undergone extensive denudation, and now frequently occurs in the form of isolated tablelands, covered by a scanty vegetation of a type locally known as spinifex grass (*Triodia irritans*), and poorly-nourished timber trees. The opals which occur in this formation, embedded in the Desert Sandstone, are distributed over the inland slopes of the eastern division of the country. They are found in great abundance south of the town of Winton (Queensland), in the Opal Range, and on the tableland separating the waters of the Diamantina and Mayne streams.

This Tertiary formation of sandstone is one of the geological puzzles of the continent, its origin being even now obscure. The late Father J. E. Tenison Woods was of opinion that it is a recent eolian or fluviatile deposit, but there are others who regard it in the light of an inland sea formation. It is considered probable that a very large body of water occupied the whole central regions of the continent in past ages, when Australia itself extended far beyond its present limits. The mountain ranges were then generally elevated above their existing level, and altogether the physical conditions were of a different and more striking character than at present. The detritus from the adjacent mountains was deposited in the bed of the impounded waters, which finally disappeared, leaving behind the material of which the Desert Sandstone is composed. This, in brief, is the inland-sea-formation theory (recently suggested by Dr. A. R. Wallace), which, in some respects, agrees with my own view of the subject.[1]

In the interior there occur several lateral and isolated ranges which do not seem to have any definable connection whatever with the mountain systems outside themselves, although composed of the same class of granite and palæozoic rocks that constitute the structural parts of the adjacent elevations of the great eastern chain and south-eastern Alpine cluster. They are very probably the product of some great local eruptive or convulsive movement of the earth's crust.

In point of age, the geological structure of the south side of the continent, occupied by the Great Australian Bight, differs materially from that to which I have alluded. Here we have an uninterrupted sequence of Tertiary deposits, extending for probably 300 or 400 miles inland, their exact limits being unknown. Along the margin of the Bight the fossiliferous Miocene limestone beds expose themselves in the form of precipitous cliffs from 300 to 600 feet in height.

The immense central basin of the continent is occupied by an

[1] In further elucidation of the subject, it may be noted that the Desert Sandstones are always on aqueous deposits of shales and clays, and though in some parts there are indications of wind drifts of sand the formation is always capped by a deposit of ferruginous aqueous rocks.

interesting series of Cretaceous beds, in which fossils are abundant. The Lower Cretaceous beds consist of soft stratified rocks upon which the Desert Sandstone rests unconformably. They are associated with a formation of soft, grey, friable sandstone grits and conglomerates, covered in places by the Upper Cretaceous bed. This highly porous rock—Blythesdale Braystone—crops out over an area estimated to be about 5000 square miles.

The Tertiary strata are distributed in the form of a series of Drifts, ranging in age from the oldest to the most recent. These are rich in organic impressions, the fossil remains of animal and vegetable life that occur in them over a very wide range of territory indicating that the country has sustained a most vigorous fauna and flora for untold ages. The subject of this prehistoric or Post-Tertiary fauna is one of absorbing interest, for the evidence afforded by the numerous fossil remains that have been found from time to time embedded in the Post-Pliocene drifts enables us to form a mental picture of some of the remarkable animals that have inhabited the country at a fairly remote period, and to realise, to some extent at least, the conditions of life under which they existed. To those familiar with the existing marsupial life of Australia this conception will not be impossible. In point of size the extinct animals of this continent resembled the leading types that now inhabit the jungles of Africa and India. The Diprotodon, for instance, was a most remarkable and imposing beast—a massive herbivorous animal measuring some 10 feet in length and 6 feet in height. Its food consisted of the long and rank vegetation of the period that flourished in the swamps and marshes and on the lake margins. That these lacustrine conditions actually existed in the inland regions of the continent has been very clearly shown by the numerous fossil remains of the Molluscan Fauna found entombed within the Post-Pliocene drifts. In relative proportions the Diprotodon would very much resemble the present African elephant, and we may picture this giant animal moving, naturally slowly, over the vast feeding-grounds of the interior, undisturbed by the intruding footsteps of man. Associated with this great vegetable feeder was the marsupial lion (*Thylacoleo carnifex*)—a large carnivorous beast equal in size to the present African lion, but whether resembling that noble animal in natural instincts is not known. The gigantic kangaroo (*Macropus titan*) was another contemporary type of the period, and, like the present species, it was a jumper of remarkable size, standing about 14 feet in height, and probably weighing a ton. The ancient wombat was likewise an animal of enormous proportions, about the size of a tapir, but differing very little in general character from the living species. Another remarkable member of the mammalian group existed in the *Nototherium*, a massive herbivorous creature measuring some 8 feet in length and 5 in height. The alligator attained to the enormous length of over 30 feet, and was probably no less remarkable for its size than for its dangerous methods of attack. The extinct Moa was one of the gigantic types of the not very numerously represented family of wingless birds that still inhabit the country. It averaged from 10 to 13 feet in height, and was identical with the New Zealand species. Besides all

these, there occurred many truly remarkable reptiles of imposing size, including an immense lizard of some 20 feet in length. In no period of the Geological history of the continent has there existed a terrestrial fauna so distinctive in character and restricted in geographical distribution as that which dominated the interior regions of Australia during "*Nototherium*" times.[1]

The numerous clay-pans that occur all over the central portion of the continent are of special interest. They have been often enough referred to from the earliest days of inland exploration up to the present time, and their utility for impounding or conserving moderate quantities of surface rain-water has been frequently acknowledged by many thirsty travellers. We are, however, chiefly indebted to Professor R. Tait and Mr. J. A. Watt for the very latest information concerning these interesting surface features. These gentlemen, who were associated with the scientific staff of the Horn Expedition to central Australia in 1894, have given a good deal of attention to the physical and geological structure of that part of the country.

Clay-pans are small areas of very slight depression, generally from 2 to 5 feet below the surface of the ground, and they vary in size from a mere speck up to half or three-quarters of a mile in diameter. They are only met with in flat country where adequate natural drainage is absent; here the surface rain-water is drained into the natural depressions, and when completely dried up by evaporation a deposit of fine clay sediment is left behind. Thus the bed of the clay-pan becomes impervious, and water will often remain in it for some little time, probably from one to four months.

Another typical feature of the arid region of the interior is the sand-drift. The reddish argillaceous sand is distributed in the form of successive ridges resembling the waves of the ocean, and these are often arranged in parallel order, with a general north-easterly and south-westerly trend, but in some places this regularity of arrangement is not maintained.[2] It is almost unnecessary to state that the prevailing south-west wind exercises a potent influence in their arrangement and distribution. These apparently endless ridges, which vary from 30 to 40 feet in height—sometimes 70 feet or even 100 feet—are often covered by a coarse vegetation locally known as "Porcupine grass" (*Triodia*). Nothing is more distressing to the weary and thirsty traveller than these interminable ridges of sand.

The lakes of the central depression are wholly unimportant. They cover very large areas, it is true, and to any one not familiar with the local physical conditions they certainly appear very striking, the manner in which they are shown on the maps lending colour to this appearance.

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[1] It may be of some interest to mention that the special Australian Fauna did not exist until *after* the great outbursts of the basalts of the Darling Downs, as the remains of the extinct animals are found embedded in the drift resting on the basalt, in ravines which must have taken a long period to erode.

[2] The sand-ridges have a northerly direction near the southern coast of Australia, but in advancing towards the tropics they fan out to east and west, following the course of the prevailing winds.

They have probably passed through several stages of development, and in the present state they simply represent the sites of ancient river valleys having descending grades towards Spencer's Gulf. Some of even the more important ones, particularly Lake Amadeus, are very shallow, and almost dry for most part of the year. As a rule, the surface structure of most of these lakes consists of blue clay and mud, covered in places by sandy loam flats. These again are usually overlaid with a layer of white salt, and the mud deposit sometimes contains plates and crystals of gypsum. Salt water is always present a little below the surface.[1] The local vegetation is very scanty, consisting mostly of saltbush and dwarfed blue gums. From the biological viewpoint, Lake Mulligan is perhaps the most interesting of all. Here a most extensive—and quite as important as it is extensive—deposit of the fossil remains of the *Diprotodon* has recently been discovered. The skeletons were embedded in soft blue clay and mud, some of the bones and teeth of these gigantic animals being actually exposed above the surface. The position of the remains indicated that most of the animals had died in a squatting position in the place where they occur, the skeletons having been found "lying with the back upward, the head on one side, and the legs spread far apart and folded up under and alongside the body, and not embedded more than 2 feet or 3 feet from the surface." There were altogether about eighty specimens of the Diprotodon dug out of the Lake Mulligan basin, and these were scattered about over an area of several acres. The limbs of the animal were very thick, and the forelegs evidently longer than the hind ones. The skull was about 3 feet in length, and from the tip of the small short tail to the snout the creature probably measured 10 feet, the height at the shoulder being from 5 to 6 feet. Associated with these fossil bones were the remains of other extinct animals, representing the leg casts of a giant bird as large as the Moa, as well as the teeth and other structural portions of a large wombat and a kangaroo. The length of the foot of the kangaroo was about 14 inches. Geologically considered, the whole of the remains to which I have briefly alluded evidently belong to the Post-Tertiary period.

The geological as well as the physical structure of the Australian continent has been greatly influenced by the action of heat and associated volcanic forces, now quiescent. The high eastern rim of the central basin is prominently marked and scored by eruptive forces, and these were widely distributed over the northern and southern portions of the country as well, the ash beds and ash cones being still preserved throughout these regions; whilst the basaltic rocks so largely developed over wide areas of the territory in question indicate that there was a time when the outbursts were very great indeed. The south-east corner of the continent seems to have been the scene of greatest activity, for

[1] The salt marshes hereabouts were originally fertile fresh-water alluvial flats, during the period of an exceedingly wet climate, when the annual rainfall must have been as many feet as it is now inches. And it may further be remarked that the salt in these marshes has been derived from the Desert Sandstone, not from an ancient salt sea, as present conditions might seem to indicate.

here extinct volcano cones are very numerous, and many small lakes now occupy the sites of craters that have long ceased to belch forth the liquid lava streams from the bowels of mother earth. In Queensland there is an extensive volcanic belt including large tracts of country west of the Moreton district and an enormous stretch of the eastern coastal region. The lava-beds are of considerable extent, and the rich volcanic soils are distributed over very large areas. In some localities the active forces appear to have been quite recent, certainly not farther back than the Miocene and Pliocene periods. The last outbursts of all very probably occurred in the neighbourhood of the Murray mouth, in the south-eastern portion of South Australia and the south-west corner of Victoria. In the neighbourhood of Ballarat the cones of old volcanoes are freely scattered about over a considerable area of country, and in the same locality there occur several alternate deposits of basalt and sedimentary accumulations which show that the period of activity must have been of long duration. The great lava streams that emanated from numerous eruptive sources spread themselves out over the adjacent regions, filling up the river valleys and forming the extensive basaltic plains which lend variety to the characteristic landscape of the country.[1] It would be difficult to form an estimate of the far-reaching influence of these mighty subterranean forces of past ages upon the general surface features of the continent. That they have played an important part in moulding and regulating them there cannot be any doubt whatever, and the more recent forces may have contributed to the causes which brought about the total extinction of the prehistoric fauna. This indeed is by no means an unreasonable conjecture, for many of these areas of depression occupied by lakes and marshes would probably be filled up by volcanic action, and the vegetation of these regions might also be changed by the same cause. This suggestion is offered more in the nature of a hint than anything else, for there is probably no available evidence in support of the view. Contemporaneous with these widespread convulsions there occurred great changes in the mean level of the continent, the eastern half at least being depressed some 900 or 1000 feet lower than at present. This change would manifest itself during the Lower Pliocene period, when the base of the coast ranges and hills would probably be lashed by the ocean waves. The succeeding period saw a change in the gradual upward movement of the land, and this slow rising of the surface has continued up to recent times, not merely as a local occurrence, for there is abundant evidence in the low sandy plains between the ranges and the sea-shore to show that the western side of the continent is likewise moving upwards, probably more rapidly than the opposite one. Volcanic activity has not manifested itself in the western portion of Australia since, very probably,

[1] The basalts were erupted as a mud in many instances, as they often contain fragments of coal which has not been coked ; in other instances the coal has been changed to coke and contiguous clays and shales vitrified or baked to brick. It is above these basalts that the bones of the extinct fauna are always found.

The volcanoes which have merely erupted lava and gas belong to a more recent period.

the Carboniferous period, the physical aspect of the region indicating a long period of complete rest. In the north-west portion several extinct crater cones are said to have been discovered, and the eruptive forces of past ages are further attested by the presence of lava streams that are largely developed in the Kimberley district and in the Northern Territory.

It is perhaps of some little interest to note that in the western portion of Australia the Archæan and crystalline rocks are developed to a far greater extent than in any other part of the world. Their presence is revealed in the numerous outcrops that occur all over the country, whilst the endless parallel foldings, the irregular breaks and faults of the series, show that the contortions are very pronounced. The diorite and granite dykes, by which these rocks are broken and faulted, contain quartz-veins and iron lodes rich in auriferous deposits. The three subdivisions of this series of rocks are represented by the granite, the gneisses, and the schists, which are mostly disposed in the form of parallel belts trending north and south.

It may be interesting to allude to the rich ores associated with the rocks upon which I have so briefly touched in this very imperfect outline sketch. The natural wealth of Australia is indeed very great. Its mineral areas are vast, and, as a gold-producing country, its fame has spread to the ends of the earth. Scores of schoolboys on the other side of the globe have been fired with enthusiasm and laudable ambition in reading about the Australian goldfields. The subject has always been one which appeals very largely to the romantic and adventurous side of human nature, and consequently very few escape its fascinating influence. Once the discovery of gold is announced, men of all nationalities hastily rush to the locality, very often in face of an array of physical impediments. Geographical position is rarely considered, the one consuming desire is to "get there" at all hazards, and scores of lives have been sacrificed in the doing of it—not in Australia alone, but all the world over wherever the gold fever has raged. This gold lust has proved to be a powerful factor in opening up, in settling and developing, the country, the history of mining enterprise showing that even in the very heart of desert regions large and often permanent towns have sprung up with phenomenal rapidity, and apparently barren tracts have been rapidly converted into habitable ones, tenanted by large and prosperous communities. It is not at present intended to deal with the historical aspect of this subject, but rather to offer a few remarks upon the geographical side.

It soon became apparent to the first settlers on the shores of Port Jackson that minerals were to be found in the country, examples of gold-bearing rock having been picked up by some of the convicts, although there was a desire on the part of the authorities to conceal the fact. In Australia gold occurs in reefs and in alluvial deposits. The former kind is usually found in veins, lodes, or dykes; the latter in the beds of streams or river valleys, where large accumulations of sediment overlie the sands, shingles, and gravels of old watercourses. The reefs and veins are mostly associated with the ancient Palæozoic rocks, in

which the clays, the slates, the sandstones, and the schists are largely represented. Gold-mining is carried on to a very large extent in most parts of Australia, the principal mineral areas occurring in what may be considered the coastal regions, or wherever the Palæozoic formation is largely developed. The site now occupied by the flourishing city of Ballarat was one of the earliest theatres of British activity in the mining-field. The gold-mines within this area are numerous and phenomenally rich in ores, the city itself being a striking and monumental example of something under forty years' enterprise in the hurried quest of the precious metals. The exciting incidents of mining life that have occurred on this goldfield are strange as well as numerous, whilst the name of the city itself recalls to mind the historical Eureka Stockade episode—a happening that in its inception threatened to be serious, but which luckily terminated without any very harmful consequences.

It may be said that the mineral deposits are very largely developed in the south-eastern, the eastern, the northern, and western regions of the continent. The granite rocks that form the base of the geological structure are rich in mineral veins, such as tin, lead, silver, and copper, and they have also yielded gold, although this last-named metal more frequently occurs in the Cambrian formation. At Broken Hill, in the far western portion of New South Wales, the silver deposits are wonderfully rich, the silver-mining industry being far more extensive here than in any other part of the continent. The Broken Hill Proprietary Mine is said to be the largest of its kind in the world, the quantity of silver produced annually amounting to many million ounces. The stream tin of Australia is the product of granite rocks, having been washed out of the granites and deposited in the beds of streams, where it occurs in the form of very rich accumulations. The tin-mining industry is very important, there being thousands of miners employed in it annually. At Herberton, Queensland, and in North Australia, very rich veins of tin have been discovered, which indicate that the mineral is widely distributed over an extensive geographical range.

The copper veins of the Cambrian formation occur in the southern and northern portions of the continent. A somewhat remarkable development of copper ore occurs on the eastern coast of Queensland, at Stanage Bay, in the form of an immense pillar of about 40 feet in height, and looking somewhat like a vessel under sail, when seen at a distance. It is said to stand on the shores of the bay, in the midst of a mass of broken rocks and boulders, some being marble, others apparently a coarse ironstone intersected with bands or veins of what was taken for crystalline quartz, which stood out in sharp ridges.

Queensland enjoys the distinction of possessing what is believed to be the richest gold-mine of the world, for nothing of the kind has yet been discovered to surpass the famous Mount Morgan as an auriferous gold-producing area. The gold occurs in a formation of Tertiary age, and owes its origin to thermal action. The mountain itself lies within the great auriferous belt of the eastern Australian region, in which the remarkably rich goldfields of Charters Towers, Gympie, and Croydon

are situated. On the western side of the continent the corresponding auriferous areas are represented by the extensive goldfields of Coolgardie, Kimberley, and Yilgarn. The first of these furnishes us with another striking example of the phenomenal growth of an Australian gold-mining town. Coolgardie is of very recent creation. A few years ago the site of the town was a barren wilderness, destitute of water and apparently unfit for occupation. The place has now all the appearance of a modern city, electrically lighted, with broad streets and imposing buildings—a wonderful oasis having been created in the desert within the short period of a few years—the whole being the result of British enterprise. The first "rush" to this rich field seems to have lacked none of the enthusiasm and excitement that characterised most of its predecessors to other gold finds in Australia and elsewhere. For some time the gold fever raged very fiercely, and steamers were despatched from all the principal ports of the continent with passengers for the newly-discovered field. Mining companies were rapidly floated, both locally and in London, the shares going up to very high prices. One very serious drawback to the development of this field was met with in the absence of water. The very scanty rainfall of the district was altogether inadequate to meet the wants of a large mining community, whilst a plentiful water-supply soon became an absolute necessity for the successful working of the mines. This could not be obtained on the surface, and the geological structure of the locality rendered the prospect of obtaining water from artesian sources hopeless. The only thing to fall back on was the salt water in the bottom of the shafts and in the lake-beds. To render this somewhat precarious supply fit for human consumption the water had to be condensed, and thus an additional industry was created, in which numerous condensers were actively employed. This arrangement is, however, likely to be soon superseded by the water-supply scheme now under the consideration of the Government.

The especially valuable minerals, besides the ones that I have mentioned, which chiefly occur in the older rock formations of Australia, are lead, antimony, bismuth, tungsten, manganese, chromium, cobalt, mercury, and several others of less value. Diamonds and other precious gems are associated with alluvial gold in the Tertiary drifts and recent stream deposits.

The Permo-carboniferous formation has yielded coal and kerosene shale of excellent quality, and these deposits are extensively developed over very wide ranges of the territory.

The building stones include marble, granite, syenite, porphyry, and sandstone, which may be obtained in many localities.

To my mind, no satisfactory evidence of well-defined traces of glaciation in Australia has yet been brought forward, although the subject has been discussed. Drift ice-masses may probably have left their imprints on some of the shore rocks of former estuarial channels, but there is nothing to indicate that the whole of the continent was at any time involved in extensive ice-sheets. In point of fact, the past and present fauna and flora denote the occurrence of mild climatic

conditions, which have prevailed for ages—conditions of climate partaking more of the tropical than the arctic character. It may, however, be stated that since this was written, the following appeared in the Brisbane *Courier* of 11th March 1901 :—

"The Maitland Government Geologist for Western Australia (Mr. A. Gibb), who has completed a trip from Cue, the centre of the Murchison Goldfield, to Carnarvon, reports that during his examination of the country between the heads of the Woramel and Minilya rivers, he discovered, associated with the carboniferous rocks, an extensive deposit of glacial origin. This deposit he traced and proved over sixty or seventy miles. With the deposit were a large number of ice-scratched boulders."

Vegetation of Australia.

The vegetable wealth of Australia is no less remarkable than the mineral wealth. The forests, it is true, are not adorned by the stately oaks of Old England; not even by the giant firs of Norway, nor the supple American ash. Still they are pre-eminently grand in their luxuriance as well as in productiveness, yielding as they do the largest timber trees of the world. The colossal gums of the Dandenong Ranges are matchless in height, and, for durability, the valuable jarrah timbers of the western portions of the continent are unsurpassed. Nor are the more lowly and less vigorous forms of the vegetation less wonderful in point of variety and economic value. Taken as a whole, Australia is not a woodland country, not more than one-fourth being forested, but some parts are clothed with a mantle of most luxuriant vegetation, possessing many typical characteristic features which are nowhere else met with. The forests are vast, often enough dense, sometimes open, but always Australian in character. To those accustomed to the trees, the grasses, and the flowers of the British Isles, the flora of this continent may appear unattractive. But in reality it is not so; it possesses a beauty all its own—a beauty that is met with in the deep mountain glens of the great Alpine cluster; in the shady groves of the Pacific slope; in the solitude of the dense tropical scrubs; in the animated scrub clusters of the inland plains; in the vigorous forest areas of the salubrious tablelands; in the grass and timber interspersed areas; in the fern-tree gullies of the highland zones; in the palm-belted tracts; in the herbage-carpeted rolling downs; in the striking variety of the gums and the grasses; in the solitude of the virgin forest: in the marsupial feeding-grounds; in the shady, scented bowers, by the side of the creeks; in following the wallaby tracks of the rugged rocky ridge slopes; in the cheerful home of the wild flowers; in the evergreen mangrove regions by the seashore; in the giant vegetation of the stream borders: in the lofty timber trees of marshy grounds; in the monarchs of the Dandenong Ranges; and even among the spreading feathery-leafed cycad (*Bucephalartos MacDonnelli*) and the lofty palms (*Livistonia Mariae*) of the Finke River basin, or midst the mud-flats of the great central depression—there is wealth of natural beauty that will strike the

appreciative eye, and command the profound admiration of the soulful observer. There is too great a tendency altogether on the part of new arrivals in Australia to underrate and even sneer at the natural beauty of vegetation and scenery, and very few writers upon the subject are free from reproach. It is true there are many forest-clad areas devoid of any striking feature of what is commonly called beauty, but on the other hand there are many more where the natural beauty of the characteristic vegetation is sublimely grand.

There are three great climatic zones in which the vegetation of the continent flourishes—the *tropical*, the *temperate*, and *Alpine*. These, in their turn, may be divided into several sub-regions, denoting the character and variety of plant life. The vegetation of the tropical coastal region flourishes with greater luxuriance than in any other subdivision of the first-named zone. The same may be said of the temperate zone. The reason for this is not far to seek. Here the rainfall is far greater than in any other portion of the continent, and the soils are rich, consequently the conditions are most favourable for the vigorous growth of plants. The wealth of the tropical forest is everywhere apparent in the stately and thickly foliaged timber trees; the impenetrable scrubs of Dense Vines, and other varieties; the innumerable types of lower forms of plants and profusion of the most lovely orchids. The gums predominate, but there are numerous other species, which include valuable cedar trees, a variety of figs, and many timbers of great commercial value. This tropical flora, besides its peculiar Australian character, includes, in the northern and eastern continental regions, several Indian, Malayan, and Polynesian forms, chiefly represented by the screw pines, the mangroves, the bamboos, orchids, and several varieties of palms. The Dense Vine and other varieties of tropical scrubs are perhaps the least valuable of all the forms of vegetation. They cover extensive areas of country, and form a tangled mass of the densest possible description, into which it is impossible for invading man to penetrate. These scrubs have always effectually blocked the onward march of the explorer, and impede the progress of the land surveyor so greatly that he is paid an additional allowance of a hundred per cent. for lines in them, and even this remuneration does not "pay," for progress is painfully slow and the labour of cutting the lines is great. The scrub lands are remarkably fertile, and when denuded of the mantle of vegetation to which they supply abundant nourishment they are capable of growing phenomenally heavy crops of many kinds of cultivated products. The scrub is apparently a valley-loving form of vegetation, invading the undulating lands and plains of the sea-board, and only occasionally intruding up the range and mountain slopes in localities where the rainfall is abnormal and the air excessively humid. The scrub areas are never free from dampness, even during the dry season, consequent upon the dense nature of the vegetation, which effectually excludes the solar rays. No plant is more unwelcome to the bushman than the dreaded "lawyer" vine, armed as it is with sharp, powerful spines that strike downwards and are curved inwards. The vine grows in the form of a dense tangled mass, from which it would be most difficult to extricate the unwary traveller who might

happen to come in contact with it. The flora of the interior sub-region of the tropical zone is not remarkable for vigour of growth, the forests being comparatively open, the interspersed grass areas fairly numerous and moderately extensive, and the timber trees having a slightly dwarfed appearance. The absence of a copious rainfall is fully apparent in the general condition of the vegetation of this inland belt. The luxuriant undergrowth, which might naturally be expected in a climate essentially tropical, is mostly absent, and the surface soils have a dry, unfertile appearance, which detracts greatly from the beauty of the landscape. These existing features are all the more noticeable in localities where there is an occurrence of the Desert Sandstone, to which the lack of natural fertility may in some measure be attributed. Generally speaking, this class of country is suitable for grazing purposes, and it extends with some notable variations over the entire central basin, into the temperate zone, and across the continent to a portion of the west coastline; again south to the head of the Great Australian Bight, embracing the whole of the vast inland territory, except the desert region. The variations consist chiefly of the distribution of the vegetation and the denuded surface patches that are met with in remote places. On the great western plains of New South Wales and Queensland, for instance, the continuity of the forest is broken, and the timber trees are replaced by extensive areas of grass and other short herbage, interspersed with small belts or clusters of stunted forest growths and patches of scrub. These last-named forms differ in character from the coastal scrubs in that they are not so dense and formidable, consisting as they do mostly of dwarfed varieties of acacias, existing under climatic conditions not always highly favourable to remarkable luxuriance. The densest form is what is locally known as Brigalow scrub, which grows almost as close together as the vine species, and when an opening is cut through it the appearance of a high-walled avenue is suggested. The explorers' "Mulga" scrub, of ill-repute, is a sharp, spiny, hardy plant, found growing in the form of irregular bushes that spread out laterally and occur over very extensive tracts of the interior. Still more persistent in growth and wide geographical distribution is the dreaded "Spinifex" (*Triodia irritans*)—an irritating and animal-torturing grass, with rigid, sharp-pointed leaves that inflict painful wounds on the feet and legs of horses and other beasts of burden commonly used in the field of exploration. Many, indeed, are the sad and pitiable tales that have been told by the hardy pioneers of our country of hardships endured whilst traversing the terrible spinifex regions. This porcupine grass, sometimes so called, is a lover of waste lands, where water there is none, and flourishes in the arid sandy and rocky country where little else can grow. The appearance of such a region so destitute of other varieties of plant life is most uninviting.

The saltbush plains consist of widely distributed areas of low-lying country clothed with a saline vegetation, rather stunted, fairly nutritious, and useful as a fodder plant when grass is scarce. The vast rolling downs and meadow-like plains of Eastern Australia support a rich herbage, consisting of an almost endless variety of grasses, upon which the

immense flocks and herds of the squatting industry feed and thrive. Probably no country in the world produces such a number of different varieties of fodder plants as are met with in this portion of the continent. It is reckoned that of the three hundred and sixty kinds of grasses in Australia about three-fourths are met with in Queensland alone. A very interesting feature of this class of vegetation is exhibited in the remarkable vitality of the herbage. During periods of protracted drought the general appearance of the surface conditions of the ground impresses one with the idea that the grasses have been completely annihilated, and it is only after the first shower of rain that the deception quickly disappears. Then it seems as if some magical transformation had taken place in the restoration of the plant life.

Coming now to the temperate zone, we find a somewhat remarkable commingling of the tropical and extra-tropical flora on the one hand, and on the other a peculiar distinction between the vegetation of the eastern and western sides of the continent, the flora of the latter region, notwithstanding the comparatively poor soil in which it flourishes, being quite as rich as that of Eastern Australia, although peculiar. The reason of this difference is not clearly apparent, for geologically both regions are of the same age, the evolution of the one side being contemporaneous with that of the other. Still, the diversity is actual, not merely fanciful.

The eastern and southern sub-region of this temperate zone is thickly timbered with most luxuriant sub-tropical forests, in which many varieties of the genus Eucalyptus are highly developed. First of all, there are the monarchs of the forest, the giant "white gums" of the Dandenong Range (*Eucalyptus Amygdalina*). Many of the white gums that adorn the gullies and slopes of the Dandenong Range, and impart to the local landscape its most striking feature, are over 420 feet in height, and one mighty fallen monarch across a narrow ravine measured 480 feet in length. This latter had about 20 feet of the top broken off, so that in all probability the full height of the tree had been about 500 feet in round figures. The noble *Eucalyptus diversicolor* of the western side of the continent is little inferior in dimensions to its graceful congener of the south-eastern side, numerous examples having been found to reach fully 400 feet in height. Of the numerous species of the genus Eucalyptus none are perhaps of greater value medicinally than the *Eucalyptus globulus*, from which the valuable Eucalyptus Oil of commerce is derived. When fully matured this tree grows to a great height, and is very graceful in appearance. The essential oil of this species has acquired a world-wide reputation for its curative properties, being used in a variety of forms as a local application in cases of colds and other ailments of the respiratory organs. Most of the gum trees, I should think, possess antiseptic properties. In Australia the Eucalyptus is represented by something like 160 species, and these are distributed over almost the entire length and breadth of the continent. The timbers of the Jarrah, the Karri (*Eucalyptus diversicolor*), the red gum, the stringy-bark, and many other species, are of great commercial value. The timber produced by the Jarrah tree (*Eucalyptus marginata*) is now in great demand for street-paving purposes, it having been found, after repeated tests, to be a hard wood of

great durability. It occurs in Western Australia, where there are extensive forests of it.

The *Eucalyptus dumosa* grows in the form of a thick scrub, occupying extensive areas of the southern part of the continent. Locally it is familiarly known as the "Mallee" scrub, and it covers a very large tract of country in the western districts of Victoria, and another one, of some 9000 square miles, in the lower basin of the Murray River, within the province of South Australia. When viewed from an eminence the dark-brown foliage of this dense mass of vegetation somewhat resembles a great sea, extending far away to the horizon, with a wavy aspect corresponding with the surface undulation of the ground.

The Alpine flora of the continent is restricted in range to the lofty mountains of Victoria and New South Wales. Although these are naturally limited in number and area, it is surprising to find what a remarkably large and varied variety of plants are met with there, a great many of the genera of which are common to both hemispheres, especially Gaultheria, Gentiana, Geum, Myosostis, Ranunculus, and others.

Besides the more remarkable types to which I have alluded, the vegetation of Australia includes many others very striking in appearance. For instance, the peculiar bottle-tree, so appropriately named, is, in my opinion, one of the greatest novelties of the flora of the country. Its trunk is greatly bulged out, and from the middle it tapers to a narrow neck, from which the branches radiate. This tree is a lover of the inland tableland regions, where the sandstone formation is developed, and when once seen can never be mistaken. Two very fine examples of it may be seen growing in the premises of the Survey Office, Brisbane.

The grass-tree is another type of Nature's peculiarly moulded plants. The rugged stem of the tree, some 10 or 12 feet in height, is crowned by long narrow-bladed grass tufts, from the centre of which projects a moderately slender seed stalk that blossoms in season. This singularly beautiful plant flourishes over a very wide range of the continent, to which it imparts an unusually picturesque appearance.

The crimson-blossomed "Waratah" of New South Wales is one of the most lovely types of the remarkably numerous flowering plants of Australia. It is a short stem plant, probably six feet in height, and when in full bloom its brilliant colour affords a striking contrast to the rather dull appearance of the associated vegetation. The adoption of the Waratah as the national emblem has been suggested by some of the members of the Australian Natives' Association, but to my knowledge nothing further has been done in the matter.

Altogether there are probably about 10,000 species of flowering plants and ferns in Australia, many of which are very beautiful in variety of colour and luxuriance of growth. Most of the orchids are exquisitely lovely, strange in form, and very highly valued. But of all the lovely flowers that bloom, the giant "rock-lily" is perhaps the most interesting, producing as it does an enormous flower-stalk of considerable height.

The beautiful acacias are represented in Australia by about 300 species, a number of which constitute many of the various scrubs that form so conspicuous a feature of the landscape scenery. The entire flora of the continent is distributed in the proportion of about two-thirds temperate and one-third tropical. This unequal distribution accounts for most of the peculiar types occurring in the extra-tropical vegetation.

The plant life of the country is apparently of very great antiquity, as evidenced by the numerous fossiliferous impressions that have been discovered embedded in the rocks and the striking peculiarity of the genera of many existing forms, all of which seem to show that for untold ages the continent has sustained a very rich vegetation.

That the remarkable floral wealth of this great country should have for its elucidation commanded the services of such eminent botanical workers as Sir Joseph Hooker, Richard Bentham, Baron von Müller, and other worthies is not surprising. The scope of investigation has been very wide indeed, few fields elsewhere having afforded a wider one. It is to the energy and enthusiasm of these famous botanists and their colleagues that we are indebted for our very full knowledge of the Australian flora, knowledge recorded in the many elegant and profusely illustrated botanical tomes that adorn the shelves of the great libraries of the world. Notwithstanding all that has been done, there are still some obscure points that require further elucidation. For instance, the origin of the flora of the continent is a subject not yet clearly understood. The same may be said of the remarkable difference in the vegetation of the eastern and western sides of Australia: the strange aggregation of a number of peculiarly Australian plants in the south-west corner of the country; the reason for the close affinity between some types of vegetation common to temperate Australia, the Antarctic Islands, South Africa, and Europe.

Are these merely coincidental occurrences in the evolution of plant life? Do they imply simultaneous and independent development? Or are they the result of migratory movements?

SOME GREAT RAILWAY ENTERPRISES.

We owe the following accounts of some great railway enterprises to two of our corresponding members. To Mr. Alexander Begg, author of *A History of British Columbia*, we are indebted for the account of the proposed extension of the Trans-Siberian Railway, and also for the notes on the Grand Trunk Railway of Canada. The Rev. J. Bryant, of New South Wales, has furnished us with the account of the projected Trans-Continental Railway in Australia.

A Railway round the World.

Our American cousins, domiciled immediately south of us, across the 49th parallel of latitude, are emphatically an enterprising people. They

aim after large enterprises and big schemes. The latest in which they desire to have a share is in the building of a railway extending round the world. They are said to have approached the Czar of Russia with an offer to connect and complete the eastern end of the Siberian Transcontinental Railway at Vladivostok to Cape Numaino at Behring Strait.

The offer which a United States syndicate is said to have made to the Emperor of Russia is, that "the syndicate will furnish the money, build the road, and operate it for a term of years; then transfer it to the Russian Government at a price based upon its actual cost, plus ten per cent. per annum; with provision for an indemnity in case of loss in operating during the time it is in the hands of the builders. Another provision is asked for, namely, the cession to the syndicate of certain lands, tillable and mineral, along its route."

From the latest published statements, it appears that Russia has built 5542 miles of the Siberian railway, at a cost of $400,000,000 (the amount of cost stated is not vouched for). The number of workmen engaged for nearly ten years in its construction is stated to be 70,000, required to complete the road to a salt-water outlet on the Pacific, and to provide a base of military operations on the Chinese frontier. The scheme is to be extended east to Behring Sea by the United States syndicate. The great railway magnate, James J. Hill, of St. Paul, Minnesota, U.S.A., is said to be taking a lively interest in the Siberian road from Vladivostok to Behring Sea. He is said to be in possession of figures giving every elevation, every gradient, and every item of engineering data necessary to the building of a standard railway from the Canadian lines to Vladivostok, including the crossing of the Behring Strait.

This great railway scheme is not intended so much to regulate trade by restraint, as to accomplish the encircling of the earth with a double steel band, and the construction and operation of a railway system, 20,000 miles in length, traversing three continents, with one terminus at Calais, on the Channel coast of France, and the other at New York city.

A loan from the United States syndicate, backed by Morgan and Hill, is expected to furnish funds to complete the Siberian end of the road in return for certain concessions to be transferred to the syndicate, who will also build the crossing of Behring Strait, and across Alaska to the Yukon territory.

On the Russian side, the Czar's engineers have made a careful survey of the proposed extension, and have not found any such obstacles along the route as those which have already been overcome in building to the present terminus. The engineers encountered a lake at the Baikal mountains, in a cleft of the mountains, which is 1500 feet above sea-level. The lake ranges in depth from 800 to 5000 feet, and occupies an area of 12,000 square miles, with a minimum width of 30 miles.

"This vast body of water has a distinct ebb and flow and current: and its high altitude has made it peculiarly the home of violent storms and intense cold. It was determined at first to ferry the trains over this gap, and for that purpose a steel ice-crushing ferryboat was built

at a cost of $100,000,000. But the incapacity of so cumbersome an arrangement soon became manifest, and the great thickness of the ice even further limited its usefulness, so that it was decided to build around the south side of the lake, and this is now being completed."

No such impediment is met with along any part of the unconstructed right-of-way to Behring Strait, and the cost of building will not be greater than any of the Rocky mountain roads, aside from the long haul of material, and this can be obviated greatly, the engineers say, by building from the Behring Sea terminus, and supplying material from the United States by steamer.

The route *viâ* Edmonton will likely be chosen, across Athabasca, and north-westerly to Peace river, the Nelson river, and the Liard river, across a low pass in the Cassiar mountains to the head-waters of the big Salmon river, and to the Yukon by a large and fertile valley. The Pelly, Stewart, Porcupine, and other rivers will be crossed by large steel suspension bridges. The Yukon river will not be crossed, but at Nulata the route will cross to Norton Sound; thence across Fish river to Nome Hills and Cape Prince of Wales.

There need be no fear of deep snows along the northern route. At Dawson the average depth of snow is about two feet, with a maximum of four, and there is no doubt but that a far greater amount of snow falls in New York or Chicago than in any part of the interior of Alaska or the North-West Territory. The difference is, that not a flake of Alaska snow ever melts from the time of the first light fall in the autumn until the spring sun brings thaw.

That the snowfall averages about 50 feet in winter on the White Pass Road is due to the fact that as the road crosses the coast range very near the sea, the Japan current of moisture-laden warm air comes into contact with the icy blasts from the Arctic, and the vapour is at once congealed into snow. This occurs only on the coast, however, as the Japan current, if any of it happens to get into the interior, has left its moisture on the coast, and is no longer a "breeder" of snow-storms.

Behring Strait, between Cape Numiano, Siberia, and Cape Prince of Wales, Alaska, is slightly more than nineteen miles wide—a lesser distance than from Dover to Calais. Exactly between the two nearest points of the mainland are two islands. These islands are of basalt. It has been suggested that Behring Strait being so shallow might be bridged. But to one who has seen the vast ice-field and bergs of the Arctic arouse themselves at the end of winter and sweep down into Behring Sea, with all their tremendous force, such a suggestion appears foolish, to say the least.

A tunnel for Behring Sea, however, will not be nearly so difficult a matter as it would appear at first glance. To begin with, the midway islands would break the continuity of a tunnel twice, so that no section of it need be more than six or seven miles long; and already engineers have devised a system that seems to laymen to be just the thing. It is nothing more nor less than a hollow tube, such as is proposed to be used in tunnelling the St. Lawrence river at Montreal. The tube must be

powerfully built to withstand pressure, and will be bedded in the sand which exists in the straits.

The sum of about $400,000,000 (four hundred million dollars), it is said, has been spent by the Czar in building the 5542 miles to the Pacific coast. The completion of the road to Behring Sea will require to be about 4500 miles in length. It is the Emperor's boast, however, "that no other man than a Russian ever laid a finger to the plans of his road, or put a hand to their execution, excepting in the machinery, rolling stock, rails, etc., that were bought in the United States, England, or Germany. The Czar is very proud of his achievement, but Mr. Hill will probably tell him that American engineers and builders could have saved him three hundred million dollars ($300,000,000) and five years of time."

The question has been asked, Is it worth the cost? The answer is supplied, namely: "There is no more fertile land anywhere than south-eastern Siberia, and its millions of square miles of grazing, and farming, and fruit lands would support almost the world if they were employed. They have been opened and worked just sufficiently to demonstrate their value. The mines further north and in the mountains are amongst the richest on earth in gold, copper, coal, platinum, silver, salt, iron, lead, zinc, and tin."

A writer on the subject continues: "The wealth of Alaska and the North-West Territory is just becoming apparent. There are hundreds of millions of acres of land needing only that little impetus of the iron horse to develop them into the richest the world has ever known. Their mineral wealth is already apparent, and the tropical luxuriance of their swamps and forests demonstrate what they can be made to yield. Those who regard Alaska as a glacier might be set down in one of the forests in the summer-time blindfolded, and if they did not know where they were would surely think themselves in a Florida glade, or a Louisiana swamp.

"Then, too, while the summers are short, the days are twenty-four hours long, and vegetation grows all those twenty-four hours. Illinois will not raise such wheat. Puget Sound never saw such vegetables, and California never dreamed of small fruits in such prodigal profusion, as grow wild in the valleys of Alaska. The waters of Behring Sea and the Arctic, and of the internal fresh-water lakes and rivers will furnish enough fish to feed the world if need be: and the waters being extremely cold, the northern fish are noted for the delicacy of their flavour and the firmness of their meat."

All these items of wealth are apparent at the present time. The view into the future, on their account alone, is far more promising than was that of the western coast of the United States when the trans-continental roads were planned. There is that other phase of the proposition, however, that must appeal to all, namely, the saving of time in traversing the earth or any portion of it. When Jules Verne wrote his beautifully imaginative story, *Around the World in Eighty Days*, no one really believed that any such thing would ever be accomplished. The fabled record has already been beaten, and the time shortened to

sixty days or thereabout. Within ten years one may girdle the earth within twenty days!

The Grand Trunk Railway of Canada.

It may be fully expected that the Grand Trunk Railway of Canada will be extended from the Atlantic Ocean to the Pacific (the extension will be named—The Grand Trunk Pacific Railway). It is now fifty years ago since the construction of that great system was commenced. The first charter was granted by the Legislature of Canada. Although many other railways were chartered, expecting to be built in connection with the Grand Trunk, yet Montreal was made the headquarters. The Hon. James Young in his *Public Men and Public Life in Canada* says:—

"The old-fashioned stagecoach, with its 'shrill, echoing horn,' was the chief mode of travel. It was clumsy and slow, but jolly. It generally carried her Majesty's mails; and its arrival and departure in the villages through which it passed were considered events of the day. The transportation of produce and goods was a still more tedious process. Everything produced on the farm or manufactured, which required to be manufactured, as well as all kinds of groceries, hardware, and goods of every description imported into the interior of the country, had to be laboriously teamed by horses or oxen to and from tide-water. Teaming was then an extensive industry in all parts of the province."

From Portland to Montreal, that railway was opened in 1853; from Richmond to Quebec, with a branch to Three Rivers, in 1864; from Montreal to Toronto in 1856; from Toronto to Sarnia in 1858; and the original system was completed December 16, when the Victoria Bridge was opened for traffic. The line from Detroit to Port Huron, 50 miles, was leased in 1859, the Champlain roads in 1863, the Buffalo and Lake Huron in 1867. With these additions the mileage was 1377 miles, at which it remained with slight alterations until 1880. In more recent years it had absorbed the Great Western Railway, the Northern Railway, the Wellington, the Wellington Grey and Bruce, the Toronto and Nipissing, and other lines.

Some of those railways were originally built three feet, with the "narrow gauge" of three and a half feet. "The variety of gauges is one of the curiosities of early history in Canada." The original gauge of the Grand Trunk and several others was five and a half feet. There was a "battle of the gauges," which old men remember. In the United States there were five gauges, running all the way from four feet eight and a half inches, the present standard, to eight feet. The advantage of having the same car travel from Winnipeg to New Orleans did not seem to be then realised.

As far as the construction of the extension is concerned, there is no danger of anything being out of place with Mr. Hays' management, and the work may be commenced early next summer. It goes across a country which, in a few years, will, if properly attended to, supply as much wheat as any part of Canada, or any other land in the world. At the present time grades of "No. 1 hard" are being ground at Fort Vermillion, and

are used largely by the Hudson Bay Company in supplying its forts and posts in the north.

"The Grand Trunk trans-continental line, which, it is announced, will probably seek the Pacific by the Pine River Pass, and must necessarily pass through the Peace river region, will in its western section tap a vast wheatfield, the bulk of the product of which will no doubt reach the market by the Pacific slope. Although no plans are available, the Grand Trunk road will in all probability follow the northern bank of the Saskatchewan through the valley of that great river, and in that event will strike to the north of Edmonton.

"The sources of wealth to be tapped by the railway in New Ontario will be minerals, pulpwood, pine, timber, and fisheries. In Manitoba the company will no doubt secure its fair share of that tremendous trade that existing railways seem quite unable to haul. In estimating this portion of the traffic, it must not be forgotten that Manitoba produces as yet but fifty million bushels of wheat yearly, and that the most conservative estimates of the production of the Province, under normal conditions, when the land is utilised to its full advantage, place the crop at 200,000,000 bushels a year.

"We look for the greatest development, however, following upon the construction of the Grank Trunk Pacific in the territories of Saskatchewan, Assiniboia, and Alberta. The valley of the Saskatchewan has scarcely as yet been systematically traversed by the white man, and its illimitable possibilities are only beginning to be grasped. In addition to soil of the fertility necessary to the great growth of grain crops and the raising of cattle, this north country has vast areas of woodland and much coal. The same is true of northern Alberta, which, being near the Peace river country, lying close to the Rockies, affords the railway a large grain freightage business that will probably be carried on by the Pacific."

The northward reach of the new line in its westerly section will probably be better understood by remembering that the C.P.R. passes through the Rockies, scarcely 200 miles north of the international boundary. The Canadian Northern, projected by Mackenzie and Mann, and now being constructed along the southern bank of the Saskatchewan river, will, it is anticipated, use the Yellow Head Pass, about 100 miles north of the C.P.R., while the projected Grand Trunk Pacific will probably cross the divide by the Pine River Pass, 220 miles north of the Yellow Head. It will thus be seen that the Grand Trunk Pacific will cross the Rockies 500 miles north of the international boundary, and will open up in British Columbia a country away north of the Cariboa gold-fields, rich in the precious metals, and at present almost as useless to the people of Canada as if it were situated in the mountains of the moon. The Pine River Pass has an altitude of only 2440 feet, and thus seems to warrant the statement of Mr. Hays "that the Grand Trunk will have specially low grades in its Pacific section."

The railway, if constructed on the route thus outlined, will be of greater value to Canada in the opening up of large tracts of virgin territory than was the C.P.R. The latter, it is now well known, in its passage through Western Assiniboia and Alberta, was constructed in a

region well adapted to ranching, but in which the production of cereals will depend largely on irrigation. The company, recognising this, is at present planning works, which by the diversion of the Bow river, near Calgary, will irrigate a great tract of country lying between Calgary and Medicine Hat.

To the north of this, Mackenzie and Mann, by following the Saskatchewan valley, assert that they will be able to have cereals grown along every mile of their route. The same observation will unquestionably apply to the Grand Trunk Pacific. It is evident, therefore, that if the C.P.R. has done a great work for Canada, as is unquestionably the case, the Canadian Northern and the Grand Trunk Pacific will do a greater, for by their more northerly location they will avoid passing through the fringe of semi-arid country traversed by the C.P.R. between Moose Jaw and Medicine Hat, and will bring under settlement lands capable of supporting a greater population than those traversed by the most southerly of the Canadian trans-continental systems.

The Toronto *Globe*, in concluding an editorial on the subject of the extension of the Grand Trunk Pacific, says:—

"The spending of a *hundred million* of dollars in the construction of the Grand Trunk trans-continental system means much for all Canada—work for the labourer, expansion of business for the trader and merchant, activity in the great steel-works that are springing up in various sections of the country. We should, however, deprecate the spending of such a vast sum, even accompanied as it must be by great temporary prosperity, were we not actually convinced that the capital invested in the Grand Trunk continental system, as Mr. Hays has outlined it, will pay handsome returns even before the road is finished, and that the railway in the end will be as profitable as the parent lines in the Province of Ontario.

"The trade of Canada is in a very flourishing condition at present. Remarkable progress has been made during the past six years. Foreign trade has grown from $239,025,000 to $423,910,000; imports from $118,000,000 to $212,270,000; exports $121,000,000 to $211,640,000. Canadian farm products have increased from $50,591,000 to $96,313,897, and Canadian manufactures from $9,365,384 to $18,462,970; products of the mine from $8,056,600 to $34,947,574.

"Another evidence of growth is to be found in homestead entries and arrivals of immigrants. In 1893 the homestead entries were 2770, but by 1896 they had fallen to 1384. Then began a steady and rapid increase, and in 1902 they were 14,633, or more than ten times the entries for 1896. The immigrant arrivals were 67,370 for 1902, as compared with 16,835 for 1896."

A Second Trans-Continental Railway in Australia.

The project for a second trans-continental railway is far advanced. The Commonwealth Government is already pledged to the construction of the east to west line from Port Augusta to Kalgoorlie—a distance of 1021 miles. The second proposed line from south to north will have a

total length from Adelaide to Port Darwin of 1896 miles. Already the South Australia railway reaches Oohadalta, 688 miles north of Adelaide, and a short line from Port Darwin to Pine Creek, a distance of 185 miles. The connection across Central Australia, which it is proposed to make, will be therefore 1063 miles in length. The line is to be constructed upon the Land Grant principle of payment, and the second reading of the Bill has already passed the Legislative Assembly of South Australia. For every mile of railway constructed, the contracting syndicate is to have 75,000 acres of land in alternate blocks twenty miles wide, with all mineral rights except on gold-fields already proclaimed, and exemption from taxation for ten years. The whole grant of land to the syndicate would be over 90,000,000 acres, an area equal to twice the territory of the State of Victoria. Little wonder that the other States stand aghast at such alienation of Central Australian lands, and ask whether the Commonwealth Government cannot intervene.

The country to be traversed by the projected line has been the scene of vigorous exploration, though it was only in 1862 that M'Dowall Stuart made his third and successful attempt to cross the Continent from south to north. The overland telegraph line was constructed in 1872. Yet in so vast an area there still remains a large area of unknown country. Enough, however, is known to redeem Central Australia from the character of hopeless desert which had been attributed to it. Mr. Favenc has spoken of the country around the M'Donell Range as highly fertile and possessing a splendid climate. The Horn Expedition served to modify the too favourable opinion which by way of reaction against its former evil fame had been formed of this central area. Mr. Horn found the ranges formed of bare ridges, separated from each other by bare, sandy flats, varying greatly in width from a few hundred yards to many miles. Evidently the rainfall is very erratic and the country oscillates dubiously between fertility and barrenness in consequence. M'Dowall Stuart found that the Bonney in lat. 20° 24″ which was a fine river when he saw it in March had by the following September dried up to isolated water-holes. There was no water in the Upper Neale, and as the tracks of his expedition of the previous year were still visible, it seemed that no rain had fallen in the meantime. This irregularity appears to characterise Central Australia generally. There is no fixed rainy season. The M'Donell Range with its elevation of nearly 5000 ft. secures an occasional heavy downpour which fills the channels around and floods the lower country. After such a rain there is a most luxuriant growth for a time, and an explorer coming upon the scene would be misled as to its normal character.

Gold is found in the M'Donell country. On the Artlunga field the yield has averaged two and a half ounces to the ton. The geologist to the Government of South Australia reports highly as to the mineral wealth of the district. It has been officially stated also that water can be obtained at a depth of from 100 ft. to 250 ft. The thermometer falls as low as thirty degrees, and the average rainfall is set down at thirteen inches.

The Northern Territory proper, or Arnheim's Land, which is the real

objective of the projected line, is part of the immense dormant wealth of Australia. The Premier of South Australia in supporting the Railway Bill has said: "The territory is bound to become the great cattle producing country of the world; no other part is so suitable for cheap and extensive production." The Government Resident in his latest Report tells of a tour in which he crossed a stretch of about 340 miles of country "of magnificent open plains, in some places lightly timbered, consisting of a rich, black, chocolate soil heavily grassed with Flinders, Mitchell, and other first-class grasses." At present there are about 300,000 horned cattle in the territory, and it has been stated authoritatively that the country may be expected to carry 30,000,000 (thirty millions) of sheep. The area suited for agriculture is very considerable in coastal and river lands, and rice, sugar, tobacco, and coffee are grown with the greatest success. The mineral wealth of the extreme north is also most favourably reported on. The Rev. Tennison Woods, F.G.S., F.L.S., has said: "I do not believe the same quantity of mineral veins of gold, silver, tin, copper, and lead will be found in any equal area in Australia. In fact, I doubt if many provinces in any country will be found so singularly and exceptionally endowed as Arnheim's Land in respect of mineral riches." The total output of gold up to the present is officially stated at £1,695,479, taking no account of the casual winnings of the Chinese miners.

The climate of this northern portion of Australia is not as hot as its latitude would suggest, the maximum being about 96 degrees during the day, and the minimum 56 degrees at night.

The population of the Northern Territory, not reckoning Aborigines, is estimated at 4898, of whom only 338 are females. The European portion numbers 1159, and the mixed balance is Asiatic chiefly, and of this Chinese for the most part.

Port Darwin, the Port of Palmerston, as the town itself is named, is a sheltered and commodious harbour, where the Eastern cable comes ashore. The trans-continental line at this point will serve to bring the southern States of Australia so much nearer to the world's centre.

The question of handing over so enormous a portion of Central and Northern Australia to a syndicate involves not merely the question of the alienation of the land, but the grave question also of the character of the population to be settled upon it. In view of the predominant Chinese element already present in the Northern Territory, those whose ideal is a "White" Australia view the situation with alarm and call for proper safeguards at least.

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Since the above reached us, Mr. Bryant has written to inform us that the Commonwealth Premier has declared that it is not within the province of his Government to interfere with the State Government of South Australia in reference to the outrageous Land Grant upon which the railway is to be financed.

A NATURALISTS' SOCIETY AND ITS WORK.[1]

By Professor GEDDES.

THE Naturalists' Society it is proposed to form to-night I understand to mean business. It intends to be a real Society, and its proposed Museum to be a real Museum: that is, both aim from the first at plan and work upon an adequate modern scale. Its scientific outlook, the work lying before it, are just as definite as are those of the local industries; and, like them, to be efficient, it must be ambitious and progressive; and this not only in quantity of output but in quality also. To make this clear beyond possibility of misunderstanding from the very outset, we have set before us, as alike the most convenient and the most inspiring example, the Perthshire Society of Natural Science and its Museum, admittedly the best regional museum in the country, or probably anywhere. We have seen how this has grown from a single specimen cupboard to an institution of which the buildings and cases alone, without the specimens or books, represent a capital outlay of at least £8000; and we see this being conducted and utilised upon a scale certainly not inferior to that of a first-rate Public Library. And with all this going on in the neighbouring county town, one no larger than our own, it is manifest that one of the very first practical steps to be taken by us here is to accept the invitation of the Perthshire Society and go and see their Museum, in order to realise more clearly the requirements and the possibilities of our own.

Starting just one whole generation later, we have evidently considerable ground to make up; and though, like our Perth friends, growing from small beginnings and doubtless recapitulating much the same stages of development, we must pass through these, if possible, more quickly; while if we would even profit by their experience, our aims must be not less comprehensive nor less high. We cannot claim, it is true, such a large or active nucleus of professed and trained naturalists, so eminent a group of specialists as those who gathered round Dr. Buchanan White thirty years ago, and of whom several like himself gave to the work of the young Society, and in particular to the creation of its Museum, so much of the leisure and the devotion of their lives, and whose example and precept has trained up so many efficient successors. Yet we may reasonably hope that neither knowledge nor enthusiasm will be found wholly wanting among us. Nor need numbers be wanting long. A generation or two ago the educational tide was entirely against the naturalist: print and balls practically monopolised the observation of young and old alike, from the schoolboy to the veteran golfer. Now the educational tide has turned, and Nature-interest, Nature-lore, Nature-literature are all coming into place, even into honour. As a University teacher one is familiar with the swift and

[1] An address to the introductory meeting of the Dunfermline Naturalists' Society, 17th December 1902.

striking transformation of the boyish freshman into the keen young graduate, and this in the short space of five years. With the Nature note-books now being turned out from the primary and secondary schools, far better than any we, with the pupils trained in the older bookish fashion, have as yet produced in University laboratories—there is no doubt whatever that we shall have an early crop of young naturalists. The next ten years should thus produce more students of science than the past thirty, and more effective ones to boot.

The position of Perth, not only between hill and plain, river and estuary, but with its immediate region embracing both Highlands and Lowlands at their fairest and best, is no doubt of exceptional geographical advantage, and largely accounts for its leadership in Scottish, probably in British, regional natural science. Yet here the immediate geographical situation is in some respects even a more striking one, the immediate outlook upon the Forth valley even vaster than at Perth. The possibilities of excursions may at first sight seem more limited; but here we have a far easier access to the many and unexhausted wonders of the sea. On our first spring excursion westward we may both watch the sea-birds, and hear the song-birds; we may see an earlier wealth of primroses, as many daffodils as anywhere outside our Wordsworth. Or ambushed at the forest edge we may see the trooping by of a goodly herd of deer.

Whoever cares for these things is one of us, is a naturalist. What child does not care? What wise teacher therefore? What sensible parent? Nay, what intelligent practical person, however strictly confined as a rule to the interests of the business week does not feel the usefulness of such an outdoor experience even in the week's work after, the rebound from such true recreation, such mental refreshment of mingled activity and repose.

To know such places as children, to return to them again and again as older folks is not only to brighten life, to conserve or to renew health, but to increase studious efficiency and subsequent industrial efficiency; all this obviously, and as we shall see even more. Returning from our regional excursions, we shall see more interest in the familiar city itself, recognise with freshened eyes its qualities and its defects, and interpret not only its present but its past, its possibilities in the future also.

Let me illustrate one or two of these points. Recall how the main beauty of Edinburgh was just saved from imminent ruin by the timely outcry of Lord Cockburn, which was just in time to arrest the building up of the great view of the old town and castle from Princes Street. But here in Dunfermline the panorama of the main street—also unique in its beauty—has been thoughtlessly built up—that of the Glen from Bridge Street. When we have once clearly taken in the beauty of that picture, with its flowery depth, its wooded height, and seen the Abbey towers rising stately from the edge of the ravine, and not merely from the graveyard level of the ordinary approach, we shall henceforth have the reopening of this view among our hopes and purposes as citizens; we put it upon our mental list of things which have got one day or other to be done; just as the Edinburgh people have now and again planned and carried out some definite policy of improvement.

Again we see the Edinburgh citizens in one generation pitching their

rubbish into the Nor' Loch, and in the next doing their best to improve this into the present Mound. It is therefore not unreasonable to assume that Dunfermline will not always remain in the earlier stage, using as its "free toom" its particularly consecrated neighbourhood, that of St. Margaret's Cave; the more since this, like its Edinburgh analogue, is a possible roadway. Thus our increasing respect for nature may accelerate the city improvement, not merely criticise it.

But leave the local point of view for a more general, the Fifeshire, the Scottish, the British one. The colossal Forth Bridge, the Lower Station, remind us that here we are upon the Great North Road from Edinburgh and London, through Perth to Aberdeen and Inverness: while the Upper Station expresses the corresponding transverse route, east to Cupar, St. Andrews, and Dundee, and through Stirling to the west.

In the intersection of these two main routes we have the explanation of the position of Dunfermline, not only as modern county town, but as in its day the national capital. To clear up the explanation of the latter, let us accompany the intelligent tourist — that is the observer of geography as well as history—as he ascends by the old North Road from the Queen's Ferry up through the Abbey Pend and the Palace-yard to the High Street, and on again to the old North Road. Starting again westwards from the same Palace-yard, and indeed almost from the Abbey's western door, we must not fail to note what is at first sight but the private entrance to the neighbouring mansion-house, yet leads, we see, to the ancient "Dun" and its ruins, to which the city owes not only its armorial device and motto—"*Esto rupes inaccessa*" —but its very name and origin. We see not only the rare advantage for early war of this little dun, almost cut off by its loop of precipitous ravine, but also how skilfully the Stirling road below is at once commanded and covered by the tower.

Here then beside the ancient dun, and through the space which was in ancient times the Abbey fore-court and the palace-yard, we have the intersection of these two main roads, not only of Fife, but of the kingdom, the north and south road, the east and west; and we understand more fully how "the King sate in Dunfermlyne toun," not merely "drinkin' the bluid-red wine," but shrewdly settled at the exact strategic centre of his district and kingdom; and this not only as soldier and strategist, but as a practical man of affairs also, controlling the intersecting passenger and trade-routes of his district and country—at once then the junction-pointsman, the station-master, and the railway king in the Central Station of the North British lines of his period. Thus our nature-surveys and rambles not only freshen our standpoint for the picturesque aspect of our city, but for its historical and practical interpretations also, and will be found to awaken us continually, alike as thinking and as practical men.

We naturalists are nowadays more fortunate than those of a generation ago, who—to a community which sincerely believed that education was a matter of the three R's for the primary schools, and of

alternate games and grammar for the secondary ones—seemed at best harmless triflers, like "The Madman" of *Tom Brown's Schooldays.*

The Board Schools and Public Schools having alike failed with these respective panaceas, the need of technical and industrial education, and of science as an adjunct to this next became recognised; but it was for a long time believed that chemistry (more recently with a little physics) was the essential science for technical competence. No naturalist will grudge these subjects the place they have obtained in the school curriculum, much less join the present not unimportant reaction against them; but it is still for him to work out gradually, and to convince the public of the place and need and use for nature-studies also.

Going straight to the most practical points of this many-pointed argument, let me lay down two propositions, still too unfamiliar even to the advocates of nature-studies, much less to those who ignore them. First, that while the physical sciences and the mechanical handicrafts are of certain and even fundamental importance in the technical education of the urban workman, it is the natural sciences which will be found of most educative value, not only to the rustic, but to the urban organiser, and this of industry no less than of knowledge: nay further, to the organiser of commerce—indeed perhaps most of all.

I am well aware that between the training of organising ability and the collection of wildflowers there seems to most people no connection whatsoever: yet this only needs to be pointed out. Having collected your plants, you dry them, and stick each upon a piece of paper; you label it neatly and put it with its kindred varieties and species in its proper genus, and this in its order and class, within its particular case. This done, any other botanist can find the specimen as well as you; and since Linnæus, all the world's flora is thus being arranged, and all the world's collections and workers are in essential unity not only in thought but even more in business partnership, one of regular co-operation and complete organisation of interchange. This great device of Linnæus is not only applied in the modern herbarium, but in gardens and museums, but there unfortunately it remained for too long a time. Now and then, however, a fertile application of this principle is made to practical life. Thus within our own day the cataloguing of libraries has been transformed, and the accessibility of books doubled by the card-cataloguing system.

To trace how this application of botanical methods has not only increased the efficiency of American libraries, but of American education generally, or how it is thence spreading from that into American business, and thence, as stationers' catalogues show, into our own, is a subject which might profitably occupy us for a whole evening: suffice it here to note one other development of these upon the greatest scale—that of the specific institution which at this moment most completely expresses and organises the growing commercial superiority of the United States—the Commercial Museum of Philadelphia,[1] which is practically the American Ministry of Foreign Commerce.

[1] Branford, "The Commercial Museum of Philadelphia."—*Scot. Geog. Mag.*, 1902.

Just as a chemist feels at home in a gaswork or a brewery, a geologist in mine or quarry, a mechanician among looms or engines, so in this greatest world-focus and arsenal of commerce does a botanist. This stupendous museum system, of which the still incomplete plan covers fifty-two acres, has all grown up, and this in ten years or so, from and around its germ in the herbarium of the professor of economic botany; and alike in its encyclopædic and geographic completeness, its comprehensive yet minute systematisation of detail, it is a herbarium still.

Of the pitiable, the disastrous and discouraging failure of our would-be British analogue to this, the Imperial Institute, many explanations have been given, each with partial truth; but below all these we may safely come down to the essential one. Its failure was insured from the first, since, so far as science got any real share in its planning and organising at all, these were intrusted to an illustrious analytical chemist, practically innocent of classificatory science; whereas the very humblest of working naturalists from the British Museum Herbarium hard by would have saved the situation, and made the Institute what it promised to be—the reference collection and information-bureau of the production and commerce of the Empire. Since such an institution is an increasing necessity in the intensifying international struggle of commerce, this has still to be done; in fact, in a measure it is being done, as at Kew, and sporadically through other agencies, both public and private. But far fuller reorganisation is needed. This, however, can only now come, despite the fact that its need is ever more acutely felt, as the popular notion of science, and its expression in public life becomes deepened and widened from that of mere subservience to mechanical or military invention, as is too much the case at present, to that general knowledge of nature, that grasp of her order, and that comprehension of her evolution-processes, which it is the function of a society like ours to advance in its research, to express in its museum, and to diffuse throughout its entire community.

So much for the too unobserved relation of the naturalist's holiday interests and museum habits to the present-day needs of British commerce: consider next for a moment their relation to the requirements of Art-teaching, and of design in manufactures, one hitherto too little appreciated or understood by the public, and hence unsuccessfully handled by their much-abused scapegoats, the educationists—whose only fault has been to give a duly faithful parliamentary expression, a legal form, and an administrative routine to the prevalent misconceptions of their constituents.

Begin with the vast, costly, and confused national accumulations of architectural and decorative fragments, of furniture and bric-a-brac of all kinds, the South Kensington Museum, the central storehouse associated with the teaching and misteaching of art for the past half-century. Without grudging due credit to much recent improvement, compare this still confused labyrinth with the lucid and rational order of the British Museum Natural History Galleries hard by. What this great Art Museum specifically requires is to be cross-fertilised from its neighbour: that is, it has to bring from the adjacent Nature Museum its essential ideas,

and this not of course in word or on paper, but in the every-day thought and work of men trained in these, and not as hitherto in irrelevant cram for entrance examinations. Such museum curators will bring over and apply their natural history methods of presentment of the Protean forms of life in their geographical and historical order: and, in short, they will rearrange these historic fossils of the world's Art-life as plainly and instructively as they have already done its earlier and pre-human fossils.

It is two generations since Comte demonstrated the dependence of sociology upon biology, and more than one that Spencer has been elucidating and expanding it, Darwin applying it. But this cannot always remain an abstract doctrine of evolutionary philosophers; it is an urgent matter for concrete application, to our present-day life and its problems, no less than is the doctrine of energy to the economy of coal.

Coming then from the arrangement of art objects to the work of art teaching, it will not be until the art-critic has a biological training, and can do for modern and civilised art what recent evolutionists, notably Prof. Haddon,[1] have done for barbaric art, that we shall have a history of art or a grammar of ornament really worthy of the name.

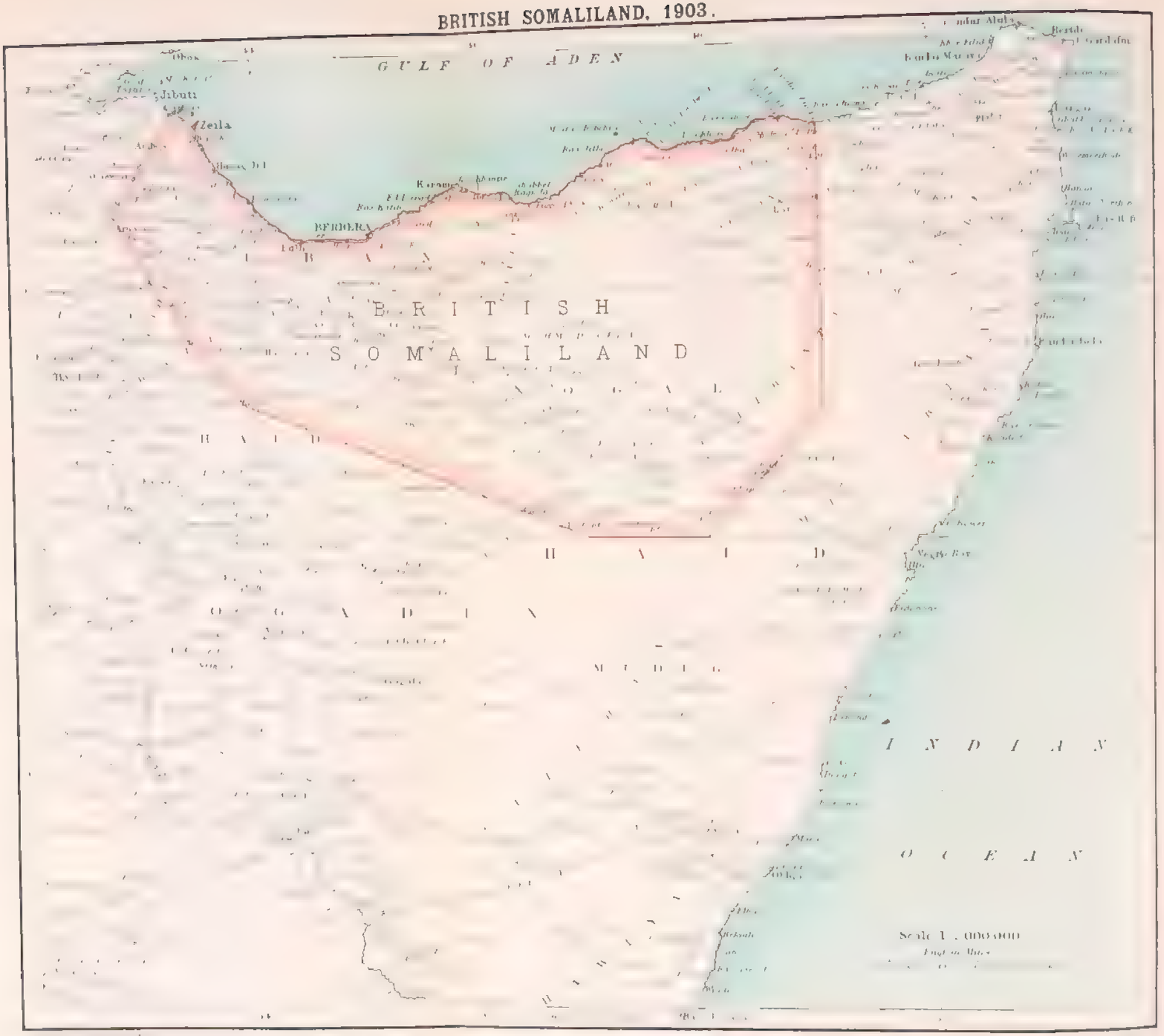
In this city, which has perhaps the highest proportion of professional designers of any in Great Britain, and of which the manufacturers, workmen, and general public are alike impressed by the importance and business value of new and original design, a plea should be hardly necessary for the advantage, nay, the necessity, to the artist of a continual return to nature. Whoever has tired of the mechanical copying of the most outworn Assyrian ornaments, and their debased Roman or Rococo reproductions, ironically named "freehand," with which South Kensington so long blighted its teachers and pupils alike, will find as good decorative motives as ever the acanthus gave in the nearest hedgerow, or may conventionalise anew from the honeysuckle as good designs as did Assyrian or Greek. Despite all one is told of the "necessity of following the fashion" and of "adapting" its designs, I cannot believe that Dunfermline designers and manufacturers will always be content to adapt the patterns of even the newest of wall-papers, or to scrape those of the oldest of French carpets upon their snowy linen; here and again they will yet dare to adorn our tables with fresh and original conventionalisings of our native flowers.

From the designs then of the local staple, or the material of its manufactures, to its international commerce, biological studies are suggestive at every point: let us next make them adequately educative, and there is no fear that they will be useful.

But man does not live by industry alone; neither can he be satisfied with the simply recreative contact with nature, vital and freshening though that be. Every mind has its deeper inquiries. In the deepest meditation of theology or philosophy, in the lightest novel reading, the very same questions are always being asked; their expression alone

[1] Haddon, *Evolution in Art*, "Contemporary Science" Series.

BRITISH SOMALILAND, 1903.



differs. For the more abstract mind the question is stated as that of determinism or freewill; while the other alternates between the novel of adventure and the novel of character. Despite the different contrasts which separate parson and congregation, philosopher and child, they all are really going on with the same problem throughout life. For with *Robinson Crusoe*, with the *Pilgrim's Progress*, both their libraries begin; these two classics which tell how environment determines occupation and life, and yet how life ever re-shapes or transcends environment.

(*To be concluded.*)

SOMALILAND.

(*With Map.*)

We publish this month a map of Somaliland, a district to which public attention has been recently drawn in connection with the expedition against the Mad Mullah. Hitherto one of the chief interests of Somaliland has been the abundance of game which its inland districts afford, and which has attracted many British sportsmen and scientists. As a whole the country suffers from great scarcity of water, which, when obtainable, is usually bad. As to physical features, the coast is fringed by a sandy desert, where the heat is great and the vegetation scanty. Even here, however, the abundant game of the interior is represented by gazelles, hares, the hyæna, and such birds as sand-grouse, bustard, and in some parts partridges. Inland, the country consists chiefly of plains, often covered with thin bush or with aloes, but the general level is higher than the coast plain, and the climate in consequence healthier and less hot. In some parts the surface is mountainous and often rocky and stony. To the south of the important village of Hargeisa lies the waterless plain known as the "haud." After the heavy rains this region furnishes good pasturage.

Hargeisa, the chief village of the interior, lies on the trade route between the coastal towns of Berbera and Bulhar on the one hand and Harar on the other. The Somali are divided into a number of tribes, and display the characteristic features of the Arab. Their wealth consists in vast flocks of camels, sheep, and goats. Most of the tribes in addition possess ponies, which they use in fighting. For food they depend upon the flesh of their flocks, but camel's milk forms also a very important part of their diet. Like all pastoral peoples they are migratory in their habits, their movements being determined by the needs of their flocks and herds. As a natural consequence their possessions are few, consisting chiefly of the material for their huts, their vessels for water, and the arms of the men. The huts, known as "karias," are made of mats which are suspended on flexible rods, both ends of which are stuck in the ground. The water-vessels, called "hans," are neatly constructed of plaited bark, and hold about three

gallons each. The offensive weapons of the men consist of two spears, the shorter of which is used for throwing and the longer in the hand-to-hand fights. A defensive shield made of hide is also carried. One of the tribes, known as the Migdans, who are keen hunters, carry bows and poisoned arrows. The dress of both sexes consists of about fourteen yards of cotton sheeting, often of British manufacture. The colour is usually white, and the "tobe," as the dress is called, covers the body from head to foot. The women go unveiled. The costume is completed by heavy sandals, made of several thicknesses of hide, and turned up at the end. The men usually wear their hair long. Both sexes are tall, good-looking, and well-developed. Much of the heavy work, which consists of loading the camels, setting up the huts, and carrying water, is done by the women.

From the waterless nature of the country, and especially from the fact that many of the grazing-grounds are some days distant from the watering-places, the camels are the most valuable possession of the Somali, and are the chief object of the looting expeditions in which the tribes so freely engage.

As regards the Fauna of Somaliland, the large carnivores are represented by numerous lions, leopards, and hyænas. The lions follow the herds of the natives in their movements over the plains. As a protection against them the Somalis when encamping construct a zareba, or thick fence made of prickly bushes. Into this the animals are driven, and within the enclosure the huts are also set up.

Hoofed animals are well represented, and include some interesting and remarkable forms. Thus we have the curious Ethiopian wart-hog, which is confined to South-Eastern Africa. Among the very abundant antelopes, mention may be made of the klipspringer, which inhabits the rocky regions, the oryx, a magnificent animal with long straight horns, gazelles, and the kudus, of which the lesser form is characteristic of Somaliland, and is very abundant in the forests of aloes. The hartebeest, so widely distributed throughout Central and Southern Africa, is also found in Somaliland. Among the odd-toed ungulates we have wild asses and the Somaliland zebra. In certain regions elephants occur, but they are apparently uncommon.

As regards the birds, ostriches, bustards, partridges, and guinea-fowl occur; there is also a very beautiful starling, with a red breast and back and wings of metallic blue.

Obbia, where the British troops disembarked, is in Italian Somaliland. All that represents a harbour is a reef which runs out parallel with the shore, forming a rough breakwater. The shore is exceedingly rocky, and is very much exposed. The country fringing the coast is composed of a wilderness of sand-dunes, producing a sand weed which serves for pasturage, but no wood or scrub of any kind. Fresh water is abundant. About fourteen miles inland the country becomes undulating and hilly.

VENEZUELA, 1903.

CARIBBEAN SEA
ATLANTIC OCEAN
VENEZUELA
COLOMBIA
BRAZIL
BRITISH GUIANA
DUTCH GUIANA
COLON TERRITORY
Los Roques
Los Hermanes
I. del Pico
Blanquilla
Margarita
Nueva Esparta
La Tortuga
Los Frailes
I. Testigos
Tobago I.
Trinidad
Port of Spain
Golfo de Paria
Serpents Mouth
Boca Araguapiche
Delta del Orinoco
Boca de Navios
Barima Pt
Scale 1 : 10,000,000
English Miles
0
100
200
Ringstown
St. Vincent 60
Barbados I.
Bridgetown
Moustique I.
Grenada
St. George
Union I.
Les Tantes
Geyave
Carriacou I.
Cannouan I.
Bequia I.
Pta Gallinas
Curaçao
Bonaire
Aruba
Los Monges
Maracaibo
Golfo de Maracaibo
Coro
Paraguana
Puerto Cabello
Valencia
Caracas
Barquisimeto
Trujillo
Merida
San Cristobal
Maracay
Barinas
Guanare
Calabozo
Carabobo
Falcon
Zulia
Lara
Los Andes
Zamora
Miranda
Bermudez
Bolivar
Yuruari
Guiana
Amazonas
Territorio Amacuro
Territorio Yuruari
Territorio Colombia
Territorio Maroa
Territorio Amazonas
Cordillera de Merida
Cordillera de la Costa
Sierra de Imataca
Sierra Parima
Sierra Pacaraima
Sierra Nevada
Cumana
Barcelona
Maturin
Carupano
Guiria
Ciudad Bolivar
Upata
Guacipati
Tumeremo
Callao
El Dorado
Ciudad Piar
Caicara
Calabozo
San Fernando de Atabapo
Puerto Ayacucho
Maroa
Esmeralda
Victorino
Tovar
Merevari
Marittari
Sanoani
Roraima
Kukenaam
Mt Roraima
Mt Ayanganna
Mt Wokomung
Mt Duida
Mt Yapacana
Mt Maraca
Mt Maturaca
Mt Tamacuari
Mt Aracamuni
Mt Parima
Mt Pacaraima

NOTES ON VENEZUELA.

(With Map.)

We publish this month a map of Venezuela, which will be of interest to students of contemporary affairs. Venezuela, or "Little Venice," contains an area estimated approximately at 590,000 square miles. In 1891 its population was 2,323,527, but this population is very irregularly distributed, large areas of the country being almost uninhabited. The people are of very mixed descent, and include a large number of full-blooded Indians.

As regards physical features, the country can be divided into three geographical regions. These are first, the Central Lowlands, including the plains, or llanos, of the Orinoco; secondly, the Northern Uplands, including the coast and inland ranges; and third, the South-Eastern Uplands, which form a complete divide between the basins of the Orinoco and the Lower Amazon. In the Northern Uplands is contained the Sierra de Merida, the highest mountain range of Venezuela. Four or five of its peaks rise above the snow-line, and within its great ridges are included barren plateaus, 11,000 feet or more above the sea-level, which are bleak, barren, and treeless in spite of their almost equatorial position. The Southern Uplands are more extensive than the Northern and less lofty; as yet they have been inadequately explored. The Central Lowlands occupy an area of 300,000 square miles, and in many parts are well watered and produce great forests. The "llanos" in the narrow sense consist of vast grassy plains which support enormous herds of horses and cattle.

As regards hydrography, the most conspicuous feature, apart from the Orinoco, is the great lagoon called Lake Maracaibo. Although this communicates with the sea, the inlet is so narrow that the great mass of the water is fresh. The lake has an area of 9000 square miles and a maximum depth of 500 feet. It was within it that Hojeda and Vespucci, who first navigated its waters, noticed a settlement of aquatic dwellings built on its margin, and comparing this to Venice, gave it the name of Venezuela, which was subsequently applied to the whole region. As well as Lake Maracaibo, Venezuela possesses another lake basin known as the lake of Valencia. This very interesting body of water has two outlets on its western side. The more southerly of these communicates with a tributary of the Orinoco, and forms either an affluent or an effluent according to the level of the water in the lake. The other outlet has sometimes communicated northwards with the Caribbean Sea. The waters of the lake are brackish and its level fluctuates greatly. The great river system of the Orinoco, which interpenetrates the country, has a drainage area of some 364,000 square miles. Its banks are fringed by magnificent forests.

As to the products of the country, both soil and climate are suited to most tropical plants. Coffee, cacao, sugar, maize, cinchona, many kinds of bark, oils, dye-woods, and so on, are all obtained. Coffee and cacao are especially important commercially, and altogether with skins

constitute the chief articles of export. The average crop of coffee is about 50,000 tons; it is chiefly sent to the United States, while the cacao for the most part finds its way to the markets of Europe. Large towns are few; only ten have a population exceeding 10,000. The capital, Caracas, has a population of 70,000. It is placed at an altitude of 3000 feet above the sea. Its port, known as La Guaira, is two miles distant as the crow flies, but owing to the steepness of the slopes is twenty-three miles by rail. There is no natural harbour, and the harbour works are very imperfect.

Industry is in a very backward state, Venezuela importing practically the whole of her manufactured goods. The largest part of her imports comes from the United States, but she is also an extensive purchaser from England and Germany. All goods are heavily taxed on entry, the revenue being mainly derived from customs duties.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a Meeting of Council held on the 14th January the undermentioned ladies and gentlemen were elected Members of the Society, viz.:—

Miss M. M. Allen.
Miss Barbara P. Paterson.
Miss J. M. Oliphant.
Miss Margaret Smith.
Miss J. C. M'Lean.
Miss J. S. Ross.
Alex. O. Gill, J.P., D.L.
Rev. David Millar, D.D.
Henry W. Renny.
C. Blair Waterston.
Lieut. Basil Hall, R.N.
A. C. Hutton.
A. B. Paterson, W.S.
J. G. W. Butler.
Allan G. Marshall.
R. Ferguson Savage.
Andrew Malcolm.
James E. Parrott, M.A., LL.D.
W. W. Stephen.
J. G. Goodchild, F.G.S., F.Z.S.
Dr. John Horne, F.R.S.
James S. Dalziel, W.S.
Henry Alexander.
Adam Dawson.
James Wallace, C.E.
John Gillon Dawson.
David Mackie.
Peter Crombie.
David Peacock.
John Murray, M.A.
R. M. Macdonald.
George Oliver.

Meetings in January.

On the 27th, in Edinburgh, Mr. W. Albert Hickman, B.Sc., read a paper entitled "Canada: Some Relations of Physiography to Development." Sir John Murray, K.C.B., occupied the Chair.

On the 26th, at Dundee, Mr. Hickman read a paper entitled "The Canadian West: A Story of Extraordinary Development." The Chair was taken by A. B. Gilroy, Esq. Mr. Hickman repeated this paper at Aberdeen on the 28th, and at Glasgow on the 29th. The Earl of Aberdeen presided at Aberdeen, and Dr. Paul Rottenburg was the Chairman at Glasgow.

GEOGRAPHICAL NOTES.

EUROPE.

Local Magnetic Focus in Hebrides.—In the course of a recent survey in the Hebrides, Captain A. Mostyn Field, in H.M.S. *Research*, found and examined an area in the entrance of east Loch Roag, Lewis, where there is considerable local magnetic disturbance. A plan showing the deviation from the normal declination of the compass needle at different positions in the area is given in *Nature* for November 27. Unfortunately, no special magnetic instruments were on board, and therefore no observations on the dip or force could be made. It is hoped to complete the observations later. The maximum deviation is 11° W.

The remarkable point in this instance is not only the magnitude of the disturbing force, the depth of water, and therefore the distance of the compass from the bottom being 100 ft., but that the north point of the needle is repelled from the apparent line of magnetic disturbance, and not attracted towards it as is usually the case in northern latitudes.

ASIA.

Earthquakes in Central Asia.—A Reuter message states that at 9.30 A.M. on December 16, Andijan, in the province of Fergana, Russian Central Asia, was totally destroyed by an earthquake. Andijan is a town of about 50,000 inhabitants. According to a rough estimate 16,000 houses have been destroyed and 2500 persons killed as a result of the earthquake. Subterranean rumblings and tremblings of the earth continue. At New Marghelan, the capital of Fergana province, the shock lasted nearly three minutes. The direction was from north-east to south-west.

AFRICA.

Survey of Jebel Garra.—A reconnaissance-survey of Jebel Garra and the oasis of Kurkur, which lie to the west of Assuan and the first cataract on the Nile, has been made by Dr. John Ball (Survey Department, Public Works Ministry, Cairo, 1902). Jebel Garra (540 metres above sea-level) is a huge, flat-topped hill capped by Eocene limestone, which stands on the margin of the plateau and scarps of Upper Cretaceous strata bordering the Kurkur Oasis. These overlook the low, undulating country formed of Nubian sandstone which occupies the intervening desert, where much blown sand occurs. The Kurkur Oasis is formed by the confluence of several wadies or drainage-channels, which have no outlet, and it contains two wells. There is little hope of the oasis being able to maintain more than a few human beings, and at present there are no residents. The water occurs at an altitude of 330 metres, and it appears to be derived rather from local rain-

water, which drains through the Cretaceous white limestone, than from any more permanent underground supply.—*Nature*, Dec. 18.

Geographical Survey of Madagascar.—General Gallieni gives an account of the progress made in the geographical survey of this island since the French occupation. Before the campaign of 1895 nine-tenths of the island were still unknown. Although several maps existed, these, owing to the difficulty of exploration, presented many blank areas. Further, although in certain regions the topography was more completely given, yet as this had been based upon the statements of natives, it was found later to be largely erroneous. Exception should, however, be made in regard to the central plateau, where the Jesuit Fathers had made numerous astronomical and geodetic observations which furnished a basis for their exact and valuable maps. But there did not exist a complete map capable of satisfying the needs of the civil and military administration. In order to produce such a map, all the resources of modern scientific geography have been utilised. The result now is that it is at last possible to study the geography of Madagascar as a whole, by the aid not only of scientifically constructed maps, but also by means of exact monographs on the different regions. Practically the whole of the island has been surveyed, with the exception of some small areas in the forest of the north-east and some thorny deserts in the extreme south, which as yet have not been penetrated by the European.

General Gallieni illustrates his article by a chart showing the extent to which the triangulation of the island has been carried on between the years 1895 and 1901.—*La Géographie.*

AMERICA.

Volcanic Disturbances in Guatemala.—In the *National Geographic Magazine* for December some account is given of the devastation and death caused by the eruptions, from October 25 to November 9, of Santa Maria, a volcano in western Guatemala, about 50 miles from the Pacific coast. The country for a radius of over 30 miles was laid waste, and over 7000 persons (mostly Indians) lost their lives. Ten Indian villages were completely wiped out, and all the coffee plantations in the volcanic zone were ruined, their owners being left penniless. The greatest distress prevailed, thousands of people being in a more or less starving condition. The damage to the country is said to be beyond repair.

The Canadian Northern.—The following note has been sent to us by Mr. Alexander Begg.—Mr. Greenshields, who is solicitor for the Canadian Northern Railway, has been in Victoria lately, along with D. D. Mann, of Mackenzie and Mann. Mr. Greenshields visited Seattle during the week, and at an interview there is reported to have said: "I have seen several reports that the Canadian Northern road was allied with the Great Northern of the United States. This is not a fact. There is nothing in common between them. The Mackenzie and Mann road will be operated in opposition to and in competition with both the American lines and the Canadian Pacific."

"At the present time the Great Northern is completed from Port Arthur to Prince Albert, a distance of 1350 miles. From Prince Albert it will run almost due west to Fort Edmonton, and it is the expectation that it will be there by the spring of 1904. Whether or not it is extended to the Pacific coast depends entirely on the action of the British Columbia government in granting a subsidy. If it does, then we will build, and if it does not, then we will not. In time, when

CHILIAN AND ARGENTINE FRONTIERS
AS DETERMINED BY BRITISH ARBITRATION

Scale 1 : 10,000,000
English Miles
New Arbitration Frontier shown thus
Former Chilian claims beyond Frontier
Former Argentine claims beyond Frontier
Longitude West of Greenwich
PACIFIC OCEAN
ATLANTIC OCEAN
SOUTH
SOUTH
Great Plateau of Patagonia
TERRITORY OF THE CHUBUT
TERRITORY OF SANTA CRUZ
TERRITORY OF THE RIO NEGRO
TERRITORY OF NEUQUEN
TERRITORY OF THE TRAVESIA DEL NORTE
TERRITORY OF THE TRAVESIA DEL SUR
TERRITORY OF TIERRA DEL FUEGO
Chiloe
Golfo de Penas
Chonos Archipelago
Peninsula of Tres Montes
Campana I.
Madre de Dios Archipelago
Golfo de San Matias
S. José or Valdes Peninsula
G. de San Jorge (G. of S. George)
Bahia Blanca
Staten I.
Cape Horn
Strait of Magellan
Desolation I.
Queen Adelaide Arch.
Hanover
Vidal I.
Contreras I.
Nelson Str.
Cambridge
Augustas I.
Concepcion Str.
Trinidad G. & Chan.
Parallel Pk.
Dyneley B.
Campana I.
Break Off Pt.
Duke of York I.
Port Henry
Manning I.
Northumberland Archipelago
Pulton Chan.
Guia Narrows
Tarn Pk.
Guaianeco Pt.
Fallos Ch.
C. Dyer
Tamar I.
Penas Gulf
Boca de Canal
Tres Montes
Peninsula
Chonos Archipelago
Tenac Inlet
Bahia Ana Pink River
C. Taytao
Duende I.
Taytao
M. Encinas
Peninsula
Tres Montes
Golfo de Penas
Guayteca I.
Guayteca Grande
Huafo Romanzo I.
Chiloe
S. Carlos de Ancud
Valdivia
Pto de Corral
Rio Bueno
Manzano B.
LLANQUIHUE
Monte
Chiloe
G. de Chorornades
S. Carlos de Ancud
C. Metalqui
Huafo
Guayteca I.
Guayteca Grande
Chonos Archipelago
Tenac Inlet
Bahia Ana Pink River
C. Taytao
Duende I.
Taytao
M. Encinas
Peninsula
Tres Montes
Golfo de Penas
Campana I.
Break Off Pt.
Parallel Pk.
Dyneley B.
Pueton Chan.
Northumberland Archipelago
Manning I.
Trinidad G. & Chan.
Port Henry
Madre de Dios Archipelago
Duke of York I.
Concepcion Str.
Hanover
Augustas I.
Cambridge
Nelson Str.
Contreras I.
Vidal I.
Queen Adelaide Arch.
Strait of Magellan
Desolation I.
Otway B.
Deepwater Str.
Breaker Coast
Longford Str.
Grafton I.
Stokes B.
Cockburn I.
Camden I.
Desolate B.
Stewart I.
Adventure Pass.
Loudonderry I.
Wellington I.
Waterman Str.
Christmas Sd.
Hoste I.
Navarin I.
Wollaston Is.
Cape Horn
Staten I.
Tierra del Fuego
Strait of Magellan
Bahia Grande
Puerto de Sta Cruz
Santa Cruz
Puerto S. Julian
Puerto Deseado
C. de las Virgenes
Pt Dungeness
Arenas Pt
San Sebastian B.
C. San Sebastian
Rio Chico
Mission Sta.
C. Ste Ines
C. San Pablo
Bahia Gallegos
Gallegos R.
Rio Gallegos
Tigre Mt
Cov Inlet
Bahia Grande
Puerto de Sta Cruz
Santa Cruz
Puerto S. Julian
Puerto Deseado
C. de las Virgenes
Strait of Magellan
Arenas Pt
San Sebastian B.
C. San Sebastian
Rio Chico
Mission Sta.
C. Ste Ines
C. San Pablo
Tierra del Fuego
Staten I.
Cape Horn
Wollaston Is.
Navarin I.
Hoste I.
Loudonderry I.
Stewart I.
Desolate B.
Cockburn I.
Stokes B.
Grafton I.
Longford Str.
Breaker Coast
Deepwater Str.
Otway B.
Desolation I.
Strait of Magellan
Queen Adelaide Arch.
Vidal I.
Contreras I.
Nelson Str.
Cambridge
Augustas I.
Concepcion Str.
Hanover
Madre de Dios Archipelago
Duke of York I.
Port Henry
Trinidad G. & Chan.
Manning I.
Northumberland Archipelago
Pulton Chan.
Golfo de San Matias
Golfo de San Jorge
Bahia Blanca
Rio Negro
Rio Colorado
Rio Chubut
Rio Deseado
Rio Santa Cruz
Rio Gallegos
Rio Chico
Rio Chubut
Rio Negro
Rio Colorado
Bahia Blanca
Golfo de San Matias
Golfo de San Jorge
Puerto Deseado
Puerto de Sta Cruz
Puerto S. Julian
Bahia Grande
Strait of Magellan
C. de las Virgenes

British Columbia is developed, it is intended that the line shall run due west from Quesnel to Port Simpson on the Pacific coast, which will be 700 miles nearer the Orient than Victoria and Vancouver. From Port Arthur east the road will be extended to Montreal and Quebec—the latter will be the eastern terminus."

The Chile-Argentine Boundary Arbitration.—In our last number (p. 44) we gave a detailed note of the award of King Edward in regard to this question. The map which we publish this month will enable our readers to follow in detail the new frontier line.

A Sub-Tropical Solar-Physics Observatory.—In the Report of the Executive Committee to the Trustees of the Carnegie Institution is published some correspondence with Professor S. P. Langley, Secretary of the Smithsonian Institution, in regard to the establishment of a Solar Observatory in tropical or sub-tropical regions. Professor Langley points out that on scientific, economic, and humanitarian grounds it is eminently desirable than an attempt should be made to determine the heat annually sent by the sun to the earth, and the causes of its probable variation. While the establishment of a permanent observatory at a high altitude would probably be an excessively costly matter, Professor Langley points out that the establishment and maintenance for eleven years of a distinctly solar observatory under these conditions would enable us to study the sun as it has never yet been studied, and through an entire solar cycle at relatively no great cost. The information so obtained would, in all probability, enable us to forecast the years of plenty and of famine in such a country as India as surely as we may now forecast a coming storm. Professor Langley considers that an expenditure of 500,000 dollars would probably be sufficient for the purpose.

In connection with this subject, it is of some interest to notice an American criticism of the action of the Trustees of the Carnegie Institution published in the *Popular Science Monthly* for January. The main lines of criticism are twofold; first, that insufficient publicity has been given to the general scheme of policy of the Institution, as well as to the detailed reports of the Advisory Committees; in the second place, objection is taken to the form of application for grants which has been printed and approved by the Trustees. From this form it would appear that the Institution is unwilling to co-operate with other agencies or with men of science, but seeks rather to aggrandise itself at the expense of others. The critic considers that in these respects the Institution is deviating from the lines on which Mr. Carnegie's gift was made.

The State of California.—Under this title M. Paul Privat-Deschanel publishes an interesting article illustrated by a transverse section. He points out that the state is not topographically a natural area, but includes parts of the following regions:—(1) the Sierra Nevada, which consists of a core of granite, overlaid by Jurassic schists; (2) the Great Median Valley, floored by lacustrine beds of Pliocene and Post-Pliocene age, and containing auriferous deposits derived by erosion from the Sierra Nevada; (3) the coast ranges, consisting of parallel chains, possessing a certain resemblance to the Jura, and composed of Secondary and Tertiary rocks, bearing such minerals as mercury and asphalt; (4) the mountains of Klamath, a region very irregular in relief, with the surface largely covered by igneous rocks; (5) a portion of the plateau of the Great Basin, composed of Primary rocks, fissured by many faults, and bearing minerals, especially gold, along the lines of the fissures. The movements of elevation which

have produced the present form of the country have not entirely ceased ; there are still several active volcanoes, recent dislocations have appeared in Pleistocene rocks, and earthquakes are frequent.

The topography of the country varies in the five regions. The Sierra Nevada constitute a complex anticlinal of relatively recent origin. Not a few of the peaks are above the snow-line, and there are a certain number of volcanoes which have mostly become extinct recently. The westward face of the range, which receives the moisture-laden winds of the Atlantic, is deeply fissured and eroded by the action of water on the schists. In their rapid downward course to the great Californian depression, the streams have eaten out great gorges, of which the most noteworthy is that of the Yosemite. On the eastern side the range abuts upon the Great Basin, which stands at a much higher level than the great depression. The height on this side is thus lower than on the west, and on this account, and also because the climate is much drier, this side is much less deeply eroded. The great Californian Valley, which scarcely rises above sea-level, constitutes a closed basin, only opening by the narrow passage of the Golden Gate. The two streams of the Sacramento and the San Joaquin run in valleys whose slope is extremely slight, and mingle their waters before entering the Gulf of San Francisco.

The Coast Ranges do not attain any great elevation, the highest point—Mt. Bache near San Francisco—being scarcely 1150 metres in height. In the region of the Mountains of Klamath, the surface is covered by forests and pastures, due to the abundant moisture. The culminating point is the volcano of Mt. Shasta, which reaches a height of 4400 metres. The small portion of the Great Basin included in the Californian area consists of the Mohave desert. The coast-line is of the type called Pacific by Suess, and in consequence good harbours are rare—the bay of San Francisco is the commercial gateway of the country. The shore-line shelves rapidly, a depth of 2000 metres occurring within 100 kilometres of the shore.

The climate is altogether exceptional in the United States ; in the vicinity of San Francisco it recalls that of Italy, but there is considerable variation elsewhere in conformity with the varying elevation. The general character of the climate may be summed up by saying that it is of the equable maritime type with mild winters and cool summers, the rains occurring in the cold season, while the hot season is dry ; the mountain districts have a high rainfall. As regards hydrography, in the Klamath district, the streams are short but carry much water ; their direction is now chiefly determined by the outflows of lava from Mt. Shasta. In the Great Basin, on account of the scarcity of rain, there are virtually no streams. Those which descend from the Sierra Nevada lose themselves in the sand as they reach the plains. Before disappearing they often form lakes, which become saline by evaporation, and are merely the remnants of much larger bodies of water in geologically recent times. In the Coast Ranges, the streams are short, but not rapid, and on account of their considerable volume of water usually navigable. Few enter the sea direct, most converge towards the Gulf of San Francisco. The Great Valley is constituted by the union of the two valleys of the Sacramento and San Joaquin. On account of the presence of the Coast Ranges neither of these rivers has any affluents to speak of on the west, but on the east many streams pour down into them from the steep slopes of the Sierra Nevada. Often dry in summer, in spring and winter these affluents pour down large volumes of water into the great rivers, hence the frequency of destructive floods, which have more than once overwhelmed Sacramento and other cities.

As regards the vegetation, it may be said to be of the Mediterranean type, for

though the species are different, the plants display similar adaptations. Thus the uniform mildness of the climate has led to the development of many evergreens, while the dryness of the hot season has led to the acquisition of leathery leaves, fitted to resist the evaporation of moisture. As these peculiarities are specially characteristic of the Conifers, we find that this family is especially well developed in California. In the Klamath region, which is colder, and more abundantly watered, the deciduous trees of western Europe flourish, while in the desert regions the typical desert plants are found. There is nothing especially characteristic in the fauna. As is well known, the population is of very mixed origin. The native Indians are rapidly diminishing and their Spanish conquerors, though successful stock-breeders, have done but little to develop the resources of the country. Though it was the discovery of gold which led to the development of the country, its influence has been largely indirect. More and more agriculture is coming to assume the first rank in the country, while the presence of mercury and asphalt especially has led to a great development of industry. Unfortunately coal is absent, but no doubt its place will be gradually filled by the utilisation of water-power. Commercially California is doubtless destined to play a great part in the trade of the Pacific.—*Bulletin de la Société de Géographie de Lyon.*

AUSTRALASIA.

Exploration in Western Australia.—We have received from the Secretary-General the recently published Journal of the Calvert Scientific Exploring Expedition, 1896-7. With the Journal is published a map showing the discoveries made by the members of the expedition. The party was under the leadership of Mr. L. A. Wells, and, as will be remembered by those who followed the course of the expedition at the time, it lost two of its members, who succumbed to the want of water and other hardships while absent from the main party on a journey. No land of any value was found in the dreary journeying over the desert, and the Journal for the most part contains accounts of the desperate struggles to obtain water. In many cases, when a long-looked-for well was reached, it was found that the amount of water obtainable was not sufficient to be worth the fearful labour of the necessary excavation in the burning sun. Another great difficulty was the constant occurrence in the more barren regions of a "poison-plant," whose name is not given. Under pressure of hunger, the camels accompanying the expedition ate this plant, and serious, and at times fatal, symptoms followed. In many cases this necessitated the tying-up of the animals, which involved very heavy labour in the gathering of forage for them.

Among minor points of interest is the observation that the domestic cat appears to exist in a feral condition over practically the whole of the unknown regions of Western Australia. In some localities the natives capture and devour a good many. There are also many notes on the birds whose presence denotes the vicinity of water, which are likely to prove of great use to future explorers. Some text-figures show the general aspect of this dreary country.

POLAR.

The Scottish Antarctic Expedition.—On Jan. 13 a cable was received from the Governor of the Falkland Islands announcing that the *Scotia* had arrived on Jan. 6 with all well on board.

The National Antarctic Relief Expedition.—From the daily press we learn that the *Morning* arrived at Lyttelton, New Zealand, on November 16, and left that

port for the Antarctic regions on December 6. The voyage out had, on the whole, been pleasant. Leaving Madeira on July 26, the course taken carried the *Morning* over to about forty miles from Pernambuco. Thence she gradually ran south-east, then east, round the Cape of Good Hope, and past the Crozet Isles and Kerguelen Island. On November 4 the vessel was south of Australia, having run 14,101 miles, and having still to go about 1500 miles before reaching Lyttelton. The *Morning* proved a capital ship, and though very bad weather was experienced for a good part of the way, not the slightest damage was sustained. During the voyage frequent entertainments were held on board, and a monthly illustrated magazine was edited. Several sailing and other vessels were met with. The *Morning* was accorded a most enthusiastic and hospitable reception by the people of Lyttelton and Christchurch, and extensive preparations were made for the entertainment of the officers and crew.

German Antarctic Expedition.—The second part of the joint publication of the Berlin Institutes for Oceanography and Geography contains full details of the voyage of the *Gauss* from Cape Town to Kerguelen. After leaving Cape Town thirteen deep-sea soundings were made along a track where none had been made before. Eleven of these were more than 1000 fathoms, five were more than 2000 fathoms, and the deepest was 2830 fathoms, in 42° 30′ S., 33° 45′ E. On Christmas Day a landing was made in one of the numerous small bays of the north-west coast of Possession Island (Crozet group). The party stepped ashore on a low basalt rock into an idyllic beast-world of slumbering sea-elephants, penguins drawn up in line, and sea-birds fluttering overhead. The coast as a whole was diversified with off-lying rocks and deeply-cut caverns, the variety being due to the contrast of the alternate horizontal sheets of hard basalt and soft volcanic agglomerate. Moss grew luxuriantly, and above the cliffs the gentle slopes were in some places deeply covered with marshy vegetation, requiring the greatest care in crossing. The sea-elephants and penguins furnished fresh meat, but the Kerguelen cabbage (nearly extirpated by rabbits) was found bitter and unpleasant.

There was no trace of glaciation on the island. A puzzling appearance was presented by the loose material covering the slopes of one of the old craters, and stretching down to the sea in stripes alternately wide and narrow in regular sequence, the wide of red, comparatively fine débris, the narrow of coarser fragments of black rock. Neither water nor wind action could account for these remarkable stone streams.

During the three hours on shore large collections were made. Fifteen flowering plants were found, three times the number of species formerly known from the Crozets, though all are of species already known from Kerguelen or other islands of the South Indian Ocean. The fauna was found very rich in insects and spiders, several of the species not yet identified being apparently unknown in Kerguelen.

The voyage to Kerguelen continued until January 2, 1902, when the *Gauss* anchored in Observatory Bay, where it met the land party under circumstances already described.

The *Gauss* sailed on January 31 for her destination in the Antarctic, with provisions for nearly three years on board. Professor von Drygalski proposed to visit, and if possible land on, Heard Island, and then make straight for Wilkes's Termination Island, sailing along the ice towards the west, so as to have the prevailing easterly winds in his favour, and ultimately turning southward and entering the ice. All on board were full of enthusiasm and confidence. The leader warns his friends not to suppose he is lost if pieces of wreckage from the *Gauss*

should be discovered at sea, for she is very likely to lose some of her gear. He thinks it possible he may be able to send news home by June 1903; but the expedition is planned for two summers in the ice, and no news will be good news till June 1904.

Dr. Bidlingmaier appends a summary of the meteorological conditions of the whole voyage out from Hamburg to Kerguelen. There are two maps and several illustrations.

GENERAL.

The Geographical Association.—The Annual Meeting of the Geographical Association was held on Jan. 9, in the lecture hall of the College of Preceptors, London. The Chair was occupied by Mr. Douglas Freshfield, President of the Association, and there was a large gathering of teachers and others. The annual report was submitted by Dr. A. J. Herbertson, the Hon. Secretary, and showed that the Association has now a membership of 278. An address was then delivered by the President, in which he emphasised the increasing necessity for a wider study of geography. Subsequently Sir J. Cockburn read a paper on the Australian Commonwealth, which was followed by a lantern demonstration on the use of Ordnance Maps in geographic education by Mr. A. W. Andrews.

Ice-Breakers in Siberia.—The *Bull. de la Soc. d'Études Coloniales*, gives the following details concerning the ice-breakers at Vladivostok and on Lake Baikal. The ice-breaker began to work at Vladivostok in 1897. It was built at Copenhagen, and is of iron, with a capacity of 1525 tons and engines of 3200 horse-power. It is 198 feet long by 42½ broad. Its services are necessary from about the end of November until March. The breaker cuts the ice, which in the Golden Horn is usually 5 to 8 feet thick, down to a depth of 7 feet, and was only once stopped—when the ice was 14 feet thick. The principal channel must in severe winters be kept open for a distance of 12 to 15 miles. The ice-breaker on Lake Baikal is 18 feet long (180 ?), has a displacement of 4200 tons, and can steam 12 knots an hour. It is very strongly built on the same lines as the *Fram*, but its stern and bow are so formed that it can steam forwards and backwards with equal facility. The deck can carry 25 travelling carriages, and 150 passengers can be accommodated in the cabin. This vessel can cut ice 26 feet thick. Another boat, steaming 12½ knots an hour, is chiefly used for the conveyance of passengers. The great difficulty is to clear the course of the broken ice as the whole lake is frozen over.

Cañon of the Colorado.—A resurvey of this region has been made, and the U.S. Geological Survey will presently publish a new map on the scale of one mile to an inch. The dimensions of the cañon have been the subject of frequent dispute. The average width from rim to rim does not exceed 10 miles in the Kaibab, the widest section, and frequently narrows down to 8 miles. The river flows at a distance varying from one to three miles from the south side. The depth of the Grand Cañon has been variously estimated. At the Bright Angel hotel, where the altitude is 6866 feet above sea-level, the drop to the high-water mark of the river has been found to be 4430 feet. The highest point on the south rim is the Grand View hotel, 7496 feet above sea-level and 4900 above the river. The north rim is 1000 to 1200 feet higher than the south, and on an average stands considerably more than a mile above the water, and in many places even more than 6000 feet. The levels from which these figures are taken are the first that have ever been run to the bottom of the chasm.—*Bulletin of the Amer. Geogr. Soc.*, No. 4, 1902.

Hot Springs and Volcanic Phenomena.—Under this title Professor Eduard Suess delivered an address before the Congress of *Naturforscher und Aertze*, held at Karlsbad this summer, and an abstract of the paper is given in the *Geographical Journal* for November. In the first place, Professor Suess defines the term "vadous," which he employs to designate all infiltrating waters, that is, those of superficial origin, as well as all the waters of the hydrosphere, as oceans, rivers, clouds, rain. Thus vadous waters, often impregnated with carbonic acid, penetrate from the surface into the upper beds of the earth's crust, and then reappear at the surface in artesian wells. Similarly, we may have vadous carbonic acid, which appears with marsh gas in coal-beds, and vadous compounds of chlorine, bromine, iodine, and sulphur in the oceans and in salt deposits. Turning then to volcanic action, Professor Suess rejects altogether the suggestion, so tempting at first sight, that the periodic outbursts of lava in *e.g.* Vesuvius, with their accompanying discharge of steam and other gases, can be due to the infiltration of vadous water, for the steam must come from a region where the temperature equals or exceeds the melting-point of most rocks, and therefore water as such could not exist. As regards the gases accompanying eruptions, a definite order can be observed. In the hottest dry fumaroles, chlorine compounds are found, and with them fluorine, boron, and phosphorus, substances which are the first to disappear when the temperature sinks. Sulphur persists longer, often combined with arsenic, while carbonic acid is found until the fumarole is comparatively cool. Now neither the abundant steam nor the carbonic acid can be vadous, both are the outward sign of that process of giving off gases which began when the earth first solidified, and which though now restricted has not yet come to an end. Volcanoes are not fed by the infiltration of sea water, but the waters of the sea are increased by every eruption. By a similar process of reasoning the author endeavours to prove that hot springs, such as those of Karlsbad, are hypogene in origin, that is, they are the survivors of volcanic activity, they originate in the depths of the earth's crust, and bring water to the surface for the first time. The Karlsbad springs bring more than a million kilogrammes of new salt to the surface every year, and with this enrich the sea, which is not the provider, but the consumer of salt. In the same way the springs enrich the atmosphere with hypogene carbonic acid, which they bring up from the depths of the earth. It is thus possible to form a complete series, beginning with the hottest dry fumaroles of volcanoes, which deposit ores by sublimation and ending with alkaline hot springs containing free carbonic acid. Intermediate between these stages, we have fumaroles of the sulphide type, which contain water, and give rise to banded deposits of ore, the succession of the deposits depending upon differential solubility. The Karlsbad springs are thus seen to form a continuous series with the mineral deposits of the Erzgebirge, which have had a similar hypogene origin.

COMMERCIAL GEOGRAPHY.

Trade with China.—In his recent report to the Foreign Office on the trade of China, His Majesty's Commercial Attaché at Shanghai, in giving some suggestions for the extension of British trade in that country, calls attention to a bill then before the Senate of the United States, providing for the erection and maintenance in Shanghai of a building, to be used as a permanent exhibition of American manufactures and raw materials, and the proposition was receiving very cordial support. The total cost was not to exceed 275,000 dollars (£55,000), and it was anticipated that the undertaking would pay for itself. While doubting if these expectations will be at once realised, Mr. Jamieson says that the idea is an excellent one. By every mail importers receive samples of goods, which it is

thought will suit the local market, but the *clientèle* thus reached is necessarily a limited one, whereas a permanent exhibition would come prominently before the public, and would most likely prove a great attraction to intending purchasers. With regard to the question of learning the Chinese language, His Majesty's Commercial Attaché remarks that it is true that classes for the study of Chinese have been instituted in the United Kingdom, which in course of time will doubtless turn out good Chinese scholars, who will at the same time prove capable men of business. But more might be done on the spot. Principals should afford facilities for learning the language to young men who are likely to interest themselves in the country, and with regard to whose qualifications in other respects they have satisfied themselves. No firm can afford to maintain purely ornamental interpreters. The difficulties of acquiring a working knowledge of colloquial Chinese have been exaggerated. The gradual opening up of the interior, too, to which all look forward so anxiously, will necessitate the training of a staff of young men who will be able to protect their employers' interest in places where English is not known, and where to trust to the average English-speaking Chinese interpreter would, in nine cases out of ten, be disastrous. This policy, it is said, has been tried with conspicuous success. At least two large British trading associations—entirely unconnected with the importation of munitions or vessels of war—have employed Chinese-speaking agents to travel about the country, and to judge by the consequent extension of business, must have reason to congratulate themselves on their pioneering enterprise.

Census of China. - M. Casenave, French Chargé d'Affaires at Pekin, gives the following figures of the Census lately published in Chinese journals :—

Provinces.	Area in sq. m.	Population.	Inhabitants per sq. m.
Chi-li,	115,800	20,930,000	181
Shan-si,	81,800	12,200,450	149
Shan-tung,	56,000	38,247,900	683
Ho-nan,	67,900	25,316,820	373
Kiang-su,	38,600	23,980,230	621
Ngan-hwei,	54,800	23,672,300	432
Kiang-si,	69,500	26,532,000	382
Che-kiang,	36,700	11,580,000	316
Fu-kien,	46,300	22,870,000	494
Hu-pei,	71,400	35,280,000	494
Hu-nan,	83,400	22,169,000	266
Shen-si,	75,300	8,450,000	112
Kan-su,	125,500	10,386,000	83
Sz'-chuen,	218,500	68,724,800	315
Kwang-tung,	100,000	31,865,200	319
Kwang-si,	77,200	5,142,000	67
Kwei-chau,	67,200	7,650,000	114
Yun-nan,	146,700	12,721,500	87
Mongolia,	1,367,900	2,580,000	1·4
Sing-Kiang (Chinese Turkestan),	550,600	1,200,000	2·4
Manchuria,	363,700	8,500,000	23
Tibet,	463,300	6,430,000	14
Totals,	4,278,100	424,428,200	99

The population given in the *London and China Telegraph* is about 1,400,000 greater than the above.—*La Géographie*, No. 5, 1902.

NEW BOOKS.

EUROPE.

Italy and the Italians. By Edward Hutton. Edinburgh: Wm. Blackwood and Sons, 1902. Pp. 343. *Price 6s.*

Written in a flowing, rhetorical style, the very opposite of "Baedeker and reality," which the author despises, this book possesses a charm of its own. "For your soul's safety," says Mr. Hutton, "you dare not look for Italy in Baedeker. You dare not follow with that shouting scarlet book in your hand, led by the button-hole by a scientific German. Italy is an unpractical land. I shall keep you in better humour than your rubicund and portly German." So this "idealist and dreamer" (as he calls himself) proceeds to dilate on Italy and the Italians in a very interesting, melodious, and vigorous way. He is evidently a great admirer of the Pope, and refers to the latter's deprivation of temporal power as "a mighty theft," forgetting that he thereby accuses nearly the entire Italian nation. He considers a reconciliation with the Church the first thing any great statesman or king would seek, and imagines that Italy would then be a country without divisions and that the socialist and freethinker would lie down with the conservative and priest. He says that "it is in leaders that Italy is unfortunately so poor. The House of Savoy has not risen to the occasion." As for the Italian Chamber of Deputies, he dismisses it, *à la* Cromwell, as a "ridiculous collection of faddists, anarchists, socialists, irreligious maniacs, and fools."

Mr. Hutton praises the novelist d'Annunzio and devotes much space to him, whilst he says comparatively little of Fogazzaro, although Luigi Villari in his recent book (*rev. S.G.M.* 1902, p. 659) told us that "to read the works of Fogazzaro after a course of d'Annunzio is like coming out of a sewer and finding oneself on an Engadine plateau." Mr. Hutton gives beautifully written descriptions of several Italian cities, accompanied, however, by such shallow remarks as "Can a heretic ever be really at home in Rome?" as if papal and not classic Rome were what was interesting there. He is steeped in admiration of the Roman Church in Italy, of which Luigi Villari (probably a better judge) is a pretty severe critic. As a glowing introduction to Italian travel Mr. Hutton's book is well worth reading, and, after so much poetic prose, one is pleased to find that the author is a practical Briton after all, and appends to his volume an excellent map of Italy by W. and A. K. Johnston.

Neue Skizzen von der Adria. II. Istrien. Graz: Leykam, 1903. Pp. 208.

In this little book Herr Joseph Stradner carefully describes Istria, its ethnography, history, and beautiful and antiquarian places of interest. With regard to its earliest inhabitants, he informs us that, however conflicting in other respects ethnographers may be, they all concur in thinking that the aborigines of Istria were racially connected with those of the neighbouring coasts—by whatever names the latter were called—and that the Celtic invasion prepared the ground for the civilisation of Rome.

ASIA.

Through Hidden Shensi. By Francis H. Nichols. London: George Newnes, Limited, 1902. *Price 12s. 6d.*

Shensi is a province in the north-west of China, and its capital, Sian, is some 750 miles from Pekin. From its position in the empire it is in the regions least

open to Europeans, and indeed comparatively little is known about it. But it to some extent emerged from obscurity at the end of last century, when it was visited by a three years' drought and famine, during which it was estimated that over two millions of souls perished out of a population of eight and a half millions. After that it again came into notice, as the province to which the Emperor of China and the Empress Dowager fled when the allied troops advanced on Pekin. It was about a year after the Imperial party had returned to the Eastern capital that Mr. Nichols was dispatched by the *Christian Herald* of New York to investigate and report on the famine conditions of Shensi for the information of the subscribers to the famine relief fund. At the outset Mr. Nichols was lucky enough to get possession of a talisman, which never failed to act like magic or to solve any difficulty, even the ultra-conservatism or inveterate prejudice of the most old-fashioned official. This was simply a visiting-card of Prince Ching, the Chinese Foreign Secretary, a piece of red paper about ten inches long and three wide, "devoid of embellishment of any kind, and would easily have passed for a Chinese laundry-ticket at home." Armed with this and the usual passport Mr. Nichols set out from Pekin in the middle of October, and reached Sian, the capital of Shensi, in the middle of November. There he met Mr. Duncan, of the British Baptist Missionary Society, who had commenced missionary operations there in 1890, and had made himself deservedly popular with all classes. Mr. Duncan took him about Shensi and its vicinity for a few days, and then both together started for Shanghai, *via* the south-east route, viz. the Han and Yangtze rivers, Hankow, and Nankin. Mr. Nichols does not conceal that although he started on his journey with a large stock of prejudice against the Chinese, his sojourn in China, and especially in Shensi, has brought about a complete change in his opinions, and he now looks on the Chinese with respect and affection, and probably it is not too much to say, with admiration. Much the most interesting parts of his book are the descriptions of the people of Shensi and its capital Sian. "No one knows when or by whom Sian was founded. From all that I have ever been able to discover on the subject, I am led to believe that when Noah was a little boy Sian was not very different from what it is to-day. Sian was a flourishing town when Fu Ni was born, and Fu Ni stands at the beginning of Chinese mystical history. Hwang-ti, the 'Yellow Emperor,' whose reign began in B.C. 2697, made Sian his capital. Hwang-ti invented carts, and bows and arrows, and devised the Chinese calendar." Of the modern city Mr. Nichols has much to tell us, and his descriptions are bright and graphic, with no attempt at redundancy or exaggeration. If space permitted, we would gladly quote his description of banks which "have existed in Sian for thousands of years, and yet the system on which their business has always been conducted is very similar to that of the United States," or of Sian society, clubs, etc. To English readers probably his most interesting chapters are those in which mention is made of the Dowager Empress, and our last quotation from this very interesting work will show that the glamour of China was sufficiently strong to convert Mr. Nichols into being an admirer of the "Jezebel of China." "As he approached the gate of a Shensi town, the Emperor usually alighted from his chair and knelt in the dust until the Empress Dowager had passed on the way to her yamen. For the five months consumed by the homeward journey the real capital of China was the yellow sedan chair of the contradictory old woman who was slowly moving across her dominions. Every day, with great regularity, came the edicts, always dated from the place where the chair happened to be resting. They showed that the Empress Dowager was certainly not leading an idle life. The question uppermost in her mind seemed always to be 'Whose head will come off to-day? . . . When

Tsz' Hi, Empress Dowager of China, left Sian, the Boxer movement had been so effectually suppressed that missionaries could travel anywhere in the province with perfect safety, and were everywhere received far more cordially than they had ever been before. The people had gone back to their farms. Excessive 'squeezing' by mandarins had been stopped by cutting off the heads of the principal offenders. Shensi was at peace. The Empress Dowager is undoubtedly a very wicked woman. She richly deserves the title of 'the Jezebel of China' by which she is often referred to in missionary reports; but if I were a Chinese resident of Sian, who, with Chinese eyes, had watched the progress of recent events in Shensi, I confess that I too should feel inclined to say 'May she live a thousand years.'" We cordially recommend this book to our readers, with the caution that in reading it they must remember that after all Mr. Nichols was only a couple of months in China, and under these circumstances his impressions and deductions, however honest and sincere, are not to be accepted as the results of wide impartial observation and matured experience, and he himself expressly states that his "narrative offers no solutions of Chinese problems, points no morals, and draws no conclusions. It is an attempt at a picture of oldest China and its people as I saw them in their land—sowing, reaping, toiling, thinking, and misjudging the world beyond their mountains as persistently as that world misjudges them."

Travels in North and Central China. By JOHN GRANT BIRCH. London: Hurst and Blackett, Limited, 1902. *Price* 10*s.* 6*d.*

There is a mournful interest attached to this work, because it is the record of the last travels of Mr. Birch in Northern and Central China in the years 1899-1900. It will be remembered that in June 1900 Mr. Birch and Captain Watt Jones were descending the Hwang-ho on a raft, which was capsized; Mr. Birch was drowned, while Captain Watt Jones escaped with his life only to meet a more terrible fate a few weeks afterwards at Kwei-kwa-cheng, where he was murdered. The object of Mr. Birch's travels was to investigate the conditions under which railways could be introduced into Northern or Central China, and he is fain to confess that his efforts to overcome the prejudices and suspicions of the ruling mandarins to whom he propounded his schemes had been utterly unsuccessful. A cardinal maxim of mandarin government is "quieta non movere." The introduction of a railway would violate this maxim, so every proposal to begin a railway was politely declined, and firmly and effectually opposed. The first chapters of the book describe travels to Kalgan on the north-west, and to Mukden on the north-east of Pekin. The greater part of the work is devoted to travels in the province of Szechuan, of which Cheng-tu is the capital. We gather, however, no fresh information regarding the manners, customs, etc., of the Chinese, although we learn that travelling among them is neither more easy nor more comfortable than it used to be. In the course of his investigations Mr. Birch often left the beaten track and went across country, and his descriptions of the scenery, agriculture, fishing operations, etc., are interesting and instructive. The work, however, adds little or nothing to the general stock of our knowledge of China. The illustrations are good, but the want of a map is a serious disadvantage to the reader.

China and the Chinese. By HERBERT ALLEN GILES, LL.D. New York: The Columbia University Press. The Macmillan Company, Agents, 1902.

This volume is a reprint of the first series of lectures delivered in March 1902 by Dr. Giles, Professor of Chinese in the University of Cambridge, at the Columbia

University in New York. They do not touch the subject of Geography in China. Nevertheless we gladly recommend them to our readers, who will doubtless gather from them much interesting and novel information regarding "China and the Chinese." The first lectures deal with the Chinese language and literature. The third gives a useful sketch of the system of Chinese government, and will correct many erroneous impressions which are very generally prevalent regarding the alleged universal corruption of the officials and oppression of the people. The fourth lecture points out the remarkable connection and affinity of China and ancient Greece. The fifth deals with the obscure subject of religions in China and more especially with Taoism. The concluding lecture is on Chinese manners and customs, and shows that many of our current beliefs on this subject, *e.g.* on the position and education of women, have no foundation in fact. The lectures are lightened by many well-told anecdotes and interesting quotations and are well worthy of perusal.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Stanford's Compendium of Geography and Travel (New Issue). *Europe*—Vol. II., *The North-West.* By Geo. G. Chisholm, M.A., B.Sc. Maps and Illustrations. London : Edward Stanford, 1902. Pp. xxiii + 372. *Price* 10*s.*

Neue Skizzen von der Adria. II. Istrien. Von Josef Stradner. Verlag "Leykam," Graz, 1902. Pp. viii + 208. Small 8vo.

Einundzwanzig Jahre in Indien, Theil III., *Sumatra.* Von Dr. H. Breitenstein. 27 Abbildungen. Leipzig : Th. Grieben's Verlag (L. Fernau), 1902. Pp. viii + 232.

Vom Kaukasus zum Mittelmeer. Von Paul Rohrbach. Leipzig : Druck und Verlag von B. G. Teubner, 1902. Pp. viii + 224. *Price* 5 *marks.*

The Via Eastern Telegraphic Social Code. Compiled by Robert T. Atkinson. London : Wm. Hutchinson and Co., Trafalgar Buildings, 1902. *Price* 5*s. net.*

The Beaumont Oil Fields, with Notes on other Oil Fields of the Texas Region. By Robert T. Hill. Philadelphia, 1902. Pp. 45.

Italy and the Italians. By Edward Hutton. Edinburgh : Wm. Blackwood and Sons, 1902. Pp. xviii + 343. Small 8vo. *Price* 6*s. net.*

The Tanganyika Problem. An account of the researches undertaken concerning the existence of Marine Animals in Central Africa. By J. E. S. Moore, F.R.G.S. With numerous illustrations and maps. London: Hurst and Blackett, 1902. Pp. xxiii + 371. 8vo. *Price* 25*s. net.*

A Naturalist in Indian Seas, or Four Years with the Royal Marine Survey Ship *Investigator.* By A. Alcock, M.B., LL.D., F.R.S. London : John Murray, 1902. Pp. xxiv + 328. 8vo. *Price* 18*s. net.*

Thorough Guide Series. Yorkshire, Part I. The East Coast, York, and the country between the NE. Main Line and the Sea ; also the Cathedral and Castle of Durham. By M. J. B. Baddeley, B.A. Twelve Maps and Plans by Bartholomew. Fourth edition, revised. London : Dulau and Co., 1902. Pp. 141.

Flavio Giola, Inventore della Bussola Moderna. Per Professor Filippo Porena. Roma, 1902.

History of Scotland, Vol. II. By Andrew Lang. Edinburgh: W. Blackwood and Sons, 1902. Pp. xiv + 575. *Price* 15*s. net.*

Guide to Annan and Neighbourhood. Historical, Traditional, Descriptive. With business Directory. By D. Watt. Annan: D. Watt and Son, 1903. Pp. lxii + 137.

The Alpujarra. Notes of a Tour in Andalusian Highlands. By K. M. Thomas. Carmarthen: W. Spurrell and Son, 1902. Pp. 92. 4to. *Price*, 2*s.*

Things Japanese. Being Notes on various Subjects connected with Japan for the use of Travellers and others. By Basil Hall Chamberlain. Fourth edition, revised and enlarged. London: John Murray, 1902. Pp. vii + 545. 8vo. *Price* 10*s.* 6*d. net.*

Among the People of British Columbia—Red, White, Yellow, and Brown. By Francis E. Herring. London: T. Fisher Unwin and Co. Pp. xvi + 299. Small 8vo. *Price* 6*s. net.*

South Africa and Its Future. Edited by Louis Creswicke. Edinburgh and London: T. C. and E. C. Jack, 1903. Pp. viii + 197. Royal 8vo. *Price* 7*s.* 6*d. net.*

Also the following Reports, etc.:—

Report of the Chief of the Weather Bureau, 1900-1901, Vol. I. In two volumes. Washington: U.S. Department of Agriculture, 1902.

Bureau of American Ethnology. J. W. Powell, Director; Bulletin 26, Kathlamet-Texts by Franz Boaz. Washington, 1901.

General Report on the Operations of the Survey of India, administered under the Government of India during 1900-1901. Prepared under the direction of Colonel St. G. C. Gore, R.E. Calcutta, 1902. *Price* 3*s.*

Annual Report of the Department of Mines, New South Wales, for the Year 1901. Sydney, 1902. *Price* 7*s.* 6*d.*

Annuario Publicado pelo Observatorio do Rio de Janeiro para o anna de 1902, Anno xviii. Rio de Janeiro, 1902.

Censimento della Popolazione del Regno d'Italia al 10 *Febbraia* 1901, Vol. I. Popolazione dei comuni e delle respettive frazioni divisa in agglomerata e sparsa e Popolazione dei mandamenti amministrativi. Roma, 1902.

Statistical Register of the Colony of Western Australia for 1900 *and Previous Years.* Perth, 1902.

Le Régime Minier aux Colonies. Documents Officiels précédés de Notices historiques. Tome I. Indes Orientales Néerlandaises, — Suriname — Guyane Française—Guyane Britannique. Bruxelles: Institut Colonial International, 1902.

Whitaker's Almanack for 1903. London: Office, 12 Warwick Lane. Pp. 792. *Price* 2*s.* 6*d. net.*

Twenty-Third Annual Report of the Victoria, British Columbia, Board of Trade. With illustrated Supplement, "Picturesque Victoria." Victoria, B.C., 1902.

Report upon the Physics and Hydraulics of the Mississippi River, upon the Protection of the Alluvial Region against Overflow, and upon the Deepening of the Mouths, based upon Surveys and Investigations. By Captain A. A. Humphreys and Lieut. H. L. Abbot. Philadelphia, 1861.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

THREE YEARS' EXPLORATION IN CENTRAL ASIA, 1899-1902.[1]

By Dr. Sven Hedin.

It was on June 24, 1899, that I left Stockholm for the fourth time in quest of new experiences and new adventures in the heart of Central Asia. That journey, which occupied a period of three years and three days, is now happily concluded. And to-night I have the pleasure and privilege of laying before you an account of my various journeyings in the centre of the great continent which I have just mentioned.

After passing through the Trans-Caspian region, I journeyed by a well-known route from Osh to Kashgar. At Kashgar I raised and equipped a caravan of fifteen camels and ten horses, and with them marched to Lailik on the Yarkand-daria. I had already crossed Eastern Turkestan in almost every direction, and the river was the only route with which I was not acquainted. Consequently I decided to make its muddy waters carry me down to the region of Lop-nor. As being the best suited for my purpose, I bought an ordinary ferry-boat, one of the kind which is ordinarily employed for ferrying goods across the river at those points where it is intersected by the caravan-routes, and fitted it up as a comfortable floating house, which became my dwelling-place for many long months. This led to a regular workshop being established in the middle of the desert, carpenters and smiths being sent for from Yarkand to make such alterations in the craft as were necessary. I had a deck fitted over the fore part, and upon that set up my tent. Its interior was fitted up as a study, a writing-table, made out of a couple of boxes, being placed at the entrance. From that vantage-ground I commanded a complete view of the river during the whole of my journey of over 1300 miles. Not a single bend, or lagoon, or sandhill, or grove of trees

[1] A paper read before the Society on December 16, 1902.

escaped my observation; all were successively plotted on my maps as we glided on past them one after the other. Amidships I had a hut erected, out of planks and black rugs, to serve as a photographic dark-room. It was provided with tables and benches, while a barrel was placed on the roof to supply water to the samovar, in which I washed my photographic plates. My baggage was stacked in the stern of the boat, and there also my servants established their quarters. In the same part of the boat they built a small fireplace of bricks, on which they cooked their food throughout the journey; while in the cool autumn evenings they kept a fire burning constantly. A smaller ferry-boat was fitted up as our larder, or store-room. On it we kept our supplies of flour and rice, grapes, melons, and pears, vegetables, live sheep, and fowls; and these last had a very great deal of cackling to do before they got accustomed to their floating home. When everything was finished, however, the boat was exceedingly comfortable, being, as it were, a sort of country house set afloat on the bosom of the great river. I also had my dogs on board, and a small English collapsible boat, which I used for short reconnoitring trips up and down the stream.

On September 17 the caravan, led by the two Cossacks, Sirkin and Chernoff, started to follow the land-route *viâ* Aksu and Korla to the rendezvous agreed upon on the Lower Tarim. With me in the boat I took my former faithful servant, Islam Bai, and five boatmen, whom I stationed with long poles one at each corner of the boat, as well as one on the provision boat, directing them to keep the flotilla from sticking fast in the bank should the current carry us too violently up against it.

When all was ready I gave the signal for the start. Our boats made their way down stream, and the hospitable shores of Lailik were speedily lost to view behind the woods. Here began a most idyllic journey. It was indeed a pleasure to live on the river, and study its pulsating life, its ebb and its flow, its capricious windings, its ever-changing shores. To me, who had been accustomed to travel on horseback, or to survey the country from the back of a swaying camel, there was an incomparable enjoyment in feeling myself carried smoothly along by the current of a peacefully flowing river.

We had only gone a very short distance when we managed to run aground. But the boatmen leapt into the water and pushed the boat off again. After that I sent the smaller provision boat on in front, to act as a pilot, and warn us of the presence of dangerous places.

I wonder how many scores of times we got stuck on sandbanks during that journey? As a rule, we camped among the woods on shore, where there was plenty of fuel. But while the crew slept on land, I slept on board. Every evening after we landed, I measured the volume of the river with the help of my collapsible boat, a velocity instrument, a sounding-pole, and a rope stretched across the stream. During the first few days the volume worked out at the rate of 3355 cubic feet per second.

At Kötteklik we descended certain rapids, which our craft shot in splendid style, without the slightest trouble. But below the rapids the force of the current was so strong that we were unable to keep

clear of the banks, and my writing-table was in great danger of going overboard.

Further on the river divided, and we drifted in amongst arms so narrow that we were only just able to force the boat along them. In other parts the stream was encumbered with driftwood; and the trunks of the poplar trees, which lay submerged at the water's edge, were not noticed until the boat swung right round upon them. At one point, where large quantities of water are drained off to feed the irrigation canals of Maral-bashi, the current dwindled to 810 cubic feet in the second, and we were obliged to requisition the natives to help in hauling our boats over the shallows. After that the country became uninhabited; and the boats glided noiselessly through the dense forests, which were often so thick that scarce a ray of sunlight pierced through to the dark hiding-places and holes in which the wild boars, tigers, and other beasts of the jungle make their lairs.

In this way we glided on day after day, week after week, down the dark waters of the Tarim, through the enchanted forests, which shut it in, as it were, along a kind of Venetian thoroughfare lined by palaces magically changed into trees, and by quays of golden shimmering reeds. When the current flowed more slowly, the boatmen nodded in turns over their punting-poles. And when the wind blew through the forest, it scattered a shower of golden poplar-leaves over the face of the river, making a golden waterway for us all through the autumn, as we followed every curve and winding of the stream. It was as though we were threading enchanted sargasso seas!

As a rule, the Tarim is very sinuous. For instance, in one case, after making a detour of over three-quarters of a mile, we found we had only advanced 200 yards in a lineal direction, or, in other words, had gone round eight-ninths of a circle in order to get over a distance equal to the remaining ninth. In this way it occasionally happened that we came back to the very same poplars which we had left behind us a few hours previously.

Upon reaching Masar-tagh I stayed there two or three days, and carried out several excursions by boat and on foot, with the view of completing the maps I made on my previous journey. The temperature sank for the first time below 0° C., that is to say, to 30° Fahr., on the night of October 12. On the evening of October 17 we were cheered by the sight of a fire blazing amongst the trees on the bank. It was made by shepherds, who were in this way seeking to scare away the tigers. As soon as they caught sight of our boat, with its spectre-like tent and its coal-black hut, gliding noiselessly between the river-banks, they took incontinently to their heels, and fled, leaving both sheep and fire to their fate. Throughout the whole of the journey we had the greatest difficulty in getting into communication with the half-wild shepherds, who pasture their flocks in the primeval forests of the Tarim. No matter how we called to them, they steadfastly refused to come and talk with us. But, at the sight of our boat, they nearly always fled away like frightened antelopes, and it was only by the exercise of little stratagems that we were able to secure them at all, and detain

them on board until their local topographical knowledge came to an end.

As the autumn advanced, we saw, both day and night, huge flocks of wild geese flying overhead, making for India by way of Yarkand. They kept regularly at an altitude of 600 or 700 feet above our heads, and the air echoed again with their discordant quackings. Unerringly they find their way along their aerial highways—those wonderful feathered pilgrims, as surely as the rivulets from the melting glaciers find their way down to Lop-nor. And truly a majestic sight it is to stand and watch them streaming onwards in their serried phalanxes, like squadrons of the sky charging on and on, on silent and untiring wings.

At length we arrived at the mouth of the Aksu-daria, and there our river met with a very noteworthy augmentation of its volume. The rate of flow of the current quickened up to nearly $2\frac{3}{4}$ miles an hour, and our boat swung right round as we glided out into the swirl of the confluence. But all went excellently well; the banks disappeared rapidly behind us, while every now and again the river was broken by rapids. For two days we travelled at the rate of $3\frac{3}{4}$ miles an hour, and consequently had to keep a sharp look-out as we raced past the woods and the *kamish* (reed) beds, at the risk of being submerged beneath the avalanche of a crumbling bank of sand. As the season grew older, it began to be sensibly cold on board. On the night of November 14 both boats froze fast in the ice, though, fortunately, it was thin, and by the end of the month the temperature had sunk 29° below freezing-point (Fahr. scale). On one occasion we had quite a dangerous adventure—our boat was carried close up underneath a high, steep bank, and a little way ahead of us we saw a poplar tree leaning out low down over the current. The punting-poles failed to touch the bottom, and my tent and every other structure on board would infallibly have gone over the side had not one of my men, in the nick of time, jumped into the ice-cold water and swum to land with a rope.

And now we began to live in daily expectation of the river freezing, for sooner or later the ice would raise an insurmountable obstacle to our further progress. Hence there began a sort of race between ourselves and it. Could we manage to get as far as our rendezvous before it came and stopped us? For several days we journeyed all day long, and often far on into the night; and for a period of ten days towards the end of November we met with rare good fortune. Some years ago the river made for itself a new bed through a sea of sand, which flung up its dunes like pyramids on either bank. This new channel gave us a short cut. But not a vestige of vegetation, not an antelope, not a human being, not even so much as a raven or a vulture, gladdened our eyes on these dreamlike, desolate banks. Here again the speed of the current was over $3\frac{1}{4}$ miles an hour, so that we sped on at a breathless pace past the sandhills, which towered up fully 350 feet above the surface of the stream.

At last it froze so hard at night that we had to chop out our boats with axes every morning. A white chain of drift-ice was trailed down the river, and jangled like a string of bells against the sides of our boats

at night. During the first days of December the river grew full of ice of this description, and most fantastic were the shapes it assumed on those evenings when we continued our journey far on into the darkness. At last, however, the ice won the upper hand. The strips of ice along the banks fastened themselves to the sides and began to grow inwards towards each other, so that the channel of open water in the middle of the river became narrower and narrower. On December 7 the ice welded the two sides of the river together. We were frozen fast, and had to go into winter quarters. The place where this happened was called Yanghi-köll, and here, by a stroke of good luck, we fell in that very same day with our caravan. Then arose, as if by magic, a small town on the desolate banks of the Tarim. Tents were pitched, *kamish* (reed) huts constructed, and stables built to shelter the animals of the caravan. In the market-place we kept burning at night a Chinese lantern swung on a pole, and this was the only lamp-post in the whole place. At this time, also, we kindled a fire, which was not allowed to go out until the end of May in the following year. Traders came to visit us from Korla and from Kuchar, and desired to barter their wares with us; in this way a lively market flourished in the wilderness.

After making an excursion into the interior of the sandy desert, I set out on December 20 from Yanghi-köll, with a caravan of seven camels, one horse, four men, and two dogs, to cross the most appalling desert on the face of all the earth—the Takla-makan—my object being to strike the town of Tatran, on the Cherchen-daria, on the other side of the desert. That meant a journey of close upon 180 miles, or twice the distance I traversed in 1895, in another part of the same desert, in the course of which the whole of my caravan perished except one man. But now it was the depth of winter, and I loaded four of the camels with blocks of ice, while two others carried fuel, and the seventh our provisions and furs. As we had no tents with us, I slept the whole of that winter in the open air, although the temperature fell 27½° below zero. As we had to husband the camels' strength, I took with us for the first two days a small reserve caravan of two men and three camels, the latter carrying ice and fuel; but on Christmas Eve I sent them back.

When we set out from our camp, the inhabitants of the district looked upon us as suicides; and both I and Islam Bai knew only too well how dangerous the journey was. The desert opened out before us like an illimitable sea, and ere two days had passed we became lost in its endless labyrinths of sand. Their conformation, however, lent us great assistance in our march. The prevailing winds blow from the east, and heap up the sand in ridges like gigantic waves, or pile it up in vast accumulations of dunes 300 to 400 feet high. These on the sheltered side go down at an angle of 33°; but on the windward side, or the east, they have a gradual slope. But in addition to these north-and-south ridges there is also another system of sand-dunes disposed at right angles to the first, that is, in lines running from east to west. These have been built up by winds blowing from the north and from the south during the winter.

The sand-dunes thus form a kind of network; and within the meshes there exist depressions which are often perfectly flat, and show the clay-soil underneath, swept free from sand. These spots the natives call "bayir." It is in depressions of this character that we find the chain of unnumbered lakes which accompany the right bank of the Tarim throughout its course.

Other circumstances of an unexpected nature also conspired to the successful issue of our enterprise. In the middle of the desert we chanced upon some plots of *kumish* (reeds); consequently the journey cost us no more than one camel. The remainder of the troop stood the journey well, as they swayed backwards and forwards like ships ploughing over the waves of the desert. The worst evil we had to contend against were the incessant storms, which whirled up the sand in front of us, so that we were quite unable to see any distance on ahead. A semi-darkness prevailed the whole of the time; and no sooner had we left the small *kumish* oases behind us, than we were again lost in the labyrinthine network of sand-dunes. To make things worse, the hard clay depressions now disappeared. If there exist sand deserts on the moon, I do not think they can possibly be more desolate than the Taklamakan!

We had also to exercise the strictest economy with our fuel; only a certain number of sticks were allowed to be doled out every evening. Hence we had to wrap ourselves up in our furs and crouch close together round the fire to keep ourselves warm, while I jotted down my notes by the light of a single wretched lantern. We were also obliged to be sparing with our ice. Yet, even though this had failed us, the heavens were kind, for in the beginning of January they took care that we should not suffer from want of water. For it began to snow, and continued snowing for several days. I used to wake up in the morning completely buried under snow, so that Islam Bai had to set to work and dig me out of my warm lair with a spade. The sandhills disappeared from sight entirely underneath the undulating sheet of snow. To sleep in the open air with 60° of frost is, however, far more interesting than agreeable. When we sat over our camp-fire we often had a temperature of 85° on the side next the fire, but a temperature of 20° below zero on the outer side of the circle.

At last, on January 8, we sighted the first tamarisk trees, and, that same evening, we encamped on the banks of the ice-bound Cherchen-daria. From this point I travelled up-country to a place called Andereh, a distance of 240 miles. Finally, by way of the ancient bed of the Etlek-tarim, now dry, and after that by unknown paths, we reached Yanghi-köll again on February 24. Here I was joined by two Buryats, or Trans-Baikal Cossacks, who had spent four months on the journey from Trans-Baïkalia.

On March 5 I was again in the saddle, with my face towards the eastern part of the desert regions, at the head of a new and well-rested caravan, made up as follows: the Cossack Chernoff, six Mussulmans, twelve camels, and one horse. My first object was to map the Kum-daria, the dried-up bed of what was formerly an outlet of the Tarim,

when that river flowed into the ancient lake of Lop-nor. The upper part of this ancient river-bed is exceptionally well defined, and contains, even at the present day, a few salt-water pools. Further on, however, it is completely dry, and in parts entirely obliterated.

But to return to our journey. One day, in the very middle of our march, we were overtaken by a sandstorm of such a violent character that the whole caravan was brought to a sudden halt. These storms loom up in the east like a black wall, and swoop down upon you like lightning, so that in an instant everything is swallowed up in an impenetrable fog of reddish yellow sand and dust. Whilst this particular storm was raging I lost touch of my caravan, and spent a considerable time wandering about before I could find it again. We could only get up one half of my tent under the shelter of a sandhill. But the sand rained in through the canvas, and every single object that was lying about became covered with it. Nay, it even gets into your mouth and grits between your teeth. To cook food in such a tempest is of course absolutely out of the question, when the wind is blowing at the rate of 47 miles an hour. A cup of water and a piece of bread was all we could get to eat. The camels lay perfectly still, with their necks stretched out to leeward, while the men were tightly muffled up in their coats. There is an amazing force locked up in these desert storms. The quantities of material they lift up and carry away, and deposit in other places, is enormous.

At last we found water at Yardang-bulak, a little well at the foot of the mountain. The well itself was tremendously salt, but the sheets of ice upon it contained fresh water. Wild camels were common in these parts, and we shot a couple.

From this point our route lay along the bed of the Kum-daria, sometimes in the channel itself, sometimes along its bank. Here on three separate occasions we came upon fragments of earthenware, showing that the banks of this river were formerly inhabited, although for centuries the ground has not been moistened with a drop of water. The further we advanced towards the east, the more desolate grew the desert. The poplar trees which stood on the banks of the river-bed were a thousand years old, and as brittle and fragile as glass—the grave-stones, as it were, of the ancient forest.

After this we came to a most remarkable oasis, namely, Altimish-bulak, or the Sixty Wells. Here again we found salt water, with big blocks of ice in close proximity. These salt-wells furnish sustenance to vigorous patches of *kumish* (reeds) and belts of tamarisks, but all huddled together within such a narrow space that it was easy to imagine we had landed upon an islet in the middle of the desert sea. When we were still a considerable distance off, the hunters of my party made out a herd of camels, consisting of an old male and five young animals, grazing amongst the bushes. The caravan came to a halt, and I went with the stalkers for the purpose of examining the creatures through my field-glass. The wild camel is certainly a wonderful animal. You find him in the dreariest parts of the desert. He only stays a short time in each oasis, but, like a ship on the ocean of the desert, is continually passing

backwards and forwards. Nobody knows how he lives. He springs up out of the dried-up earth as if he were a ghost, and vanishes like the wind, and when disturbed in his peaceful haunts does not stop in his wild flight for days and nights together.

Altimish-bulak was an important halting-place; and it was from there I proposed to cross the desert in a southerly direction. The distance to Kara-koshun, where we expected to find game, could be covered in a week, and even if our supply of water did give out, we knew that we were hardly likely to perish of thirst. Amongst other stores we took four sacks filled with ice; but, in spite of our utmost care to protect them from the sun, two pailfuls dripped away during the first day or two of the march. A few steps only away from the wells of Altimish-bulak, and we were again in mid-desert. The contour soon began to fall away gradually in the direction of the old Lop-nor lake, which was indicated by a belt of dead forest. Here we found myriads of Limnæa shells, so that the ground was in many places quite white with them. It was here, too, that Chernoff and Ördek—the latter one of the men I brought with me from Yanghi-köll—discovered the ruins of two or three houses. The beams and other parts of their wooden framework lay scattered about on the ground, half buried under dust and sand. One circumstance which at once lent a considerable antiquity to the buildings was the fact that they stood upon pediments of clay, that is to say, narrow mounds, about 8 feet high, which had been built up to suit the plan of the houses. Originally these clay footings were constructed on the level ground; but the north-east wind, in its restless activity, had scooped out the ground all around them, and swept it clean away. The clearest indications of the enormous erosive power of the wind in these parts exist everywhere throughout the desert, the clay soil being in many places furrowed with trenches 6 to 7 feet in depth in the direction in which the winds blow; and, as a consequence of this, you often appear to be marching amongst benches and tables all made of clay.

We collected specimens of the wood-carving from the houses, and dug up some Chinese coins, besides axes, sacrificial cups, and so forth. The roof of each house lay piled up on its west side, and under the shelter of the house itself. No doubt it had been hurled there by the last desert storm which it had been unable to withstand.

But as our water-supply would not allow us to stay more than twenty-four hours in this place, we were obliged to continue our march southwards, though not until I had photographed the ruins and measured the site.

That evening, just when we were going to dig a well in our new camping-ground, to get water for the camels, we discovered that we had forgotten our spade; it had been left behind in the ruins. And as the spade was an implement of great importance to us, I sent Ördek back to fetch it. Accordingly he started back the next morning, while we continued our march. Not long after this a violent sandstorm came down upon us, and we feared the worst for our solitary traveller. But Ördek's topographical instinct did not fail him. Although he lost our

track, he nevertheless succeeded in making his way back to the ruins, and, on his return with the spade, brought with him what was even more important, namely, some fresh wood-carvings, executed with still greater perfection than those we discovered first. Besides that, he also gave me information of such a character that I felt I must at all costs return to these sites of ancient civilisation. To do so then was, however, impossible; I had to control my impatience until the following winter.

Our supply of water was just on the point of giving out when we at length reached the shore of a completely new lake, which spread out to the north of the marsh of Kara-koshun. It was fed by an equally new branch of the Tarim, which left that river at Shirgeh-chappgan.

We made the return jouney in canoes, first up the new branch and then along the Tarim and the network of waterways which make up its delta. The twenty-five days this canoe journey lasted would have been very delightful had it not been for the midges, which tormented us unmercifully every evening.

I now mapped out in detail the lakes which I had discovered on my previous journey, namely, Avullu-köll, Kara-köll, Taysk-köll, Arka-köll, and Chivillik-köll, together with several others which on that occasion escaped my observation. I found that they reached a depth of 30 feet; and in one arm of the river in this same neighbourhood I sounded a depth of 41¼ feet, or seven and a half times more than anywhere else in the newly-formed marsh of Kara-koshun.

It is indeed a significant fact that the deepest depression of the Lop region is found, not at the termination of the hydrographical system, but here in the region which, from a remote antiquity, has borne the name of Lop.

The 8th of May saw us again at the Yanghi-köll, where we found everything peaceable and well. By this the river had begun to swell from the melting of the ice, and its volume now measured 3400 cubic feet in the second, or about the same as at Lailik, where I began my voyage on its waters.

Next I sent off, under the charge of the Cossack Cherdon, my big caravan of horses and mules, instructing him to make for Temirlik, in the Chimen-tagh, and after them the camels, bound for the same place, under Chernoff and Islam Bai. Meanwhile, I myself continued my journey, along with Sirkin and Shagdur, in the big boat, and so finished laying down my maps of the lower Tarim.

During the course of my journey down the big river I investigated and sounded many of the peculiar lateral or marginal lakes which lie embedded amongst the dunes of drift-sand immediately along its right bank. They are like growths or parasites, which suck away, as it were, the life-blood of the river. For instance, at the time I examined it, the lake of Karunalik was receiving through a very small feeder a volume equivalent to over 80 cubic feet in the second. Thus this one small lake alone drains away from the Tarim close upon 300,000 cubic feet of water every twenty-four hours. This then is a striking characteristic of the lower Tarim. Instead of gathering itself together and pouring

its waters in a body into the terminal basin, it filters itself away in a number of lagoons strung all alongside the principal channel. And as the lower-lying portions of the region become filled and raised by the accumulated sedimentary matters which the river brings down with it, the lateral lagoons flit steadily higher and higher up the stream. Many of these lakes are carefully preserved by the natives for the sake of the fish which they contain. First they stop up the channel which supplies the lake with water from the river. This causes the lake to become stagnant, and it begins to shrink by evaporation, whereupon the water becomes slightly salt, which is believed to make the fish bigger and more palatable. The natives catch them in a drag-net pulled along by two canoes.

In this region the river makes its way immediately along the foot of the sand-dunes. You would think these sandhills would be swept away by the unceasing wind-storms which prevail; but one I measured, which stood close to the bank, rose to a height of 295 feet, and this was not the highest I saw in that position. The simple explanation of this fact is that the river-bed shifts as the sand shifts—that is, towards the right, or westwards. And, as a matter of fact, we have seen that the Tarim formerly flowed down the bed of the Kum-daria, or nearly due east, instead of, as now, towards the south. Sometimes the river is undecided in its course. It overflows its banks and makes its way through lakes choked with reeds. Tirvadalu-köll, where it was only by the utmost exertions that we were able to punt our boat along through the unprecedentedly dense masses of *kumish* (reeds), was a lake of this description. The only way to get along was to set fire to the vegetation and burn it down to the water's edge, and then cut a channel through the tight-packed reed-stalks which remained.

On May 25 I travelled by canoe to the Lake Beglik-köll, and sounded it. The great sheet of water was as placid as a mirror, and reflected the sand-dunes with the accuracy of a camera. Towards evening, after my work was done, we landed on the west shore of the lake to rest. But Kirghin Pavan, one of my old friends who dwelt in that part of the country, pointed towards the sand-dunes in the east, and cried, in a tone of interrogation, "Kara-buran?" ("black-storm"), which signifies a desert storm of the worst description. At that moment an inky black pillar towered up on the horizon and bent its head forwards across the desert, whilst several similar pillars leapt up beside it like buttresses, supporting it. Then they melted together into one continuous wall, which rose higher and higher in the air. The lake, however, in spite of the oncoming storm, still maintained its mirror-like placidity. As we had still a good distance to row before we could enter the channel which led into the Tarim, I gave the order to start at once. The men rowed with such desperate haste that every moment I expected to hear the paddles snap in two. Their backs were bent like bows as we raced along over the sleeping waters, making the foam spin high off the bows of the canoe. We were going at the rate of 5½ miles an hour. The atmosphere was still calm, but as we watched the portentous swiftness with which the tempest bore down upon us, we felt the full premonition

of the appalling change which was about to take place. Such moments as these are magnificent, but put a severe strain upon one. "Now it 's got to the sand-dunes!" cried one of the men. I glanced up and saw the outlines of the dunes disappearing as though they were being washed off a slate, and in a moment the entire labyrinth of sand-dunes, together with the lake shore, was ingulphed in a thick yellow-grey fog. "Row, row!" shouted the Mussulmans. "Allah! Yes!" came the answer in hollow and awestruck tones.

Down came the first gusts of wind from the east-north-east. With a mighty roar the "black tempest" swooped down upon the water, which, hissing and boiling, was in two minutes lashed into huge waves of white foam. Our boat flew along at a terrific pace—nearly seven miles an hour. We were only about one mile distant from the northern shore. "By Allah! we can't do it!" was the cry. But just at the moment when the tempest seized us in its grip, and would assuredly have capsized our frail craft if we had not thrown all our weight over on to the windward side in time, we were suddenly enveloped in an impenetrable fog of the finest dust. All our surroundings were absolutely blotted out, and we became lost in the darkness. The utmost we could distinguish was the nearest waves, up and down which our canoes danced like straws.

We were at our last gasp, so to speak, when we caught the first glimpse of the tamarisks looming through the fog. The canoes were so full of water that they were ready to sink; but we were protected by a tongue of sand which acted as a breakwater. Once on the lake of Göllmeh-ghetti our two canoes did fill with water, and sank out in the open lake. But fortunately the water was so shallow that we were easily able to walk ashore. The depth in none of these lakes exceeds 36 feet, and the greatest depth is always found close to the eastern shore, under the shelter of the steep sand-dunes.

Beyond Argan the Tarim again swells out into a large and powerful river flowing in a well-defined channel. We now pushed on rapidly, often keeping it up until three o'clock in the morning to escape the gad-flies. At the fishing hamlet of Chegghelik I abandoned my trusty old craft, to the great delight of the grateful natives. The only way by which the remainder of the journey, as far as Abdal, could be accomplished was by tying our canoes together, covering them with a deck, and setting up tents upon it. At Abdal I rested some days, and made a collection of the popular songs, which for centuries have been sung by the poor but interesting fisher-folk who dwell there. Then, but with a smaller caravan, I continued my journey towards our principal camp at Mandarlik in the Chimen-tagh. And there we were all once more collected together again.

From that place I sent back Sirkin and Chernoff to Kashgar, to fetch some Chinese silver money, some tinned provisions, and my letters, and on July 20 I started upon a difficult and exhausting journey right across Eastern Tibet. My caravan consisted of six men, seven camels, twelve horses, one mule, sixteen sheep, and two dogs. The greater part of it, however, under the leadership of Shagdur and Islam Bai, was

instructed to proceed later on to Temirlik, and there wait until we joined them.

It was fine summer weather when we left Mandarlik; but we had barely gone two days' march when we encountered a violent snow-storm. Under cover of this, a band of venturesome wolves came and frightened our flock of sheep out of the camp and killed nine of them. Later on we captured two young wolves, and tried to take them with us; but one escaped, and the other gnawed himself to death.

Three days' journeying from the principal camp brought us over the mountains of Chimen-tagh, and the fourth over the parallel ranges of the Arka-tagh and Kalta-Alagan, by high but easy passes.

On the south of the Kalta-Alagan mountains the surface is level, or slopes imperceptibly down towards the sister lakes of Kum-köll, one of which, the upper lake, contains fresh water, but the other, the lower lake, salt water. Beyond these lakes again there stretched a belt of drift-sand, with dunes over 150 feet in height. The steppe was dotted with thousands of grazing *khulans*, or wild-asses.

During the latter part of July we marched straight on south, towards the Arka-tagh, and crossed successively its four parallel chains one after the other. This tried the animals' strength severely; but they came through it all right. On August 8 we went over the fourth of the parallel chains of the Arka-tagh and descended into the great longitudinal valley which I traversed in 1896. Here we encamped on the shore of a salt lake in a region of unmitigated sterility. The very bottoms of the valleys are here some 350 feet higher than the summit of Mont Blanc. Next we floundered into a region which, for pure "cussedness," is absolutely without a parallel. The surface consisted of sand and mud, saturated with water like a bog, so that the animals sank in it up to their knees. The moisture, becoming thickened by the snow and hail, does not run off the ground, but sinks down into it, making it soft and spongy and fearfully treacherous. Our animals kept falling incessantly, and every time had to be unloaded before they could be got up again.

After crossing two fresh mountain chains, with extensive, but short, glacier-fields, we encamped, on August 21, on the northern shore of an unusually large salt lake. This I decided to cross by boat in the company of one man, Kutchuk, to act as boatman, while the caravan went round by the west side to a point indicated on the opposite or south shore.

The course I steered across this very remarkable lake was towards the south-east. The eastern shore was not, however, visible. Our six-foot punting-poles touched the bottom in almost every part; and the boat itself had to be carried more than a mile before it could be made to float. The bottom of the lake was covered with a thick encrustation of salt, over the rugged surface of which it was not pleasant to walk barefoot. The water is so salt that the indicator of my hydrometer came to a standstill a couple of inches above the surface, and I had to make a special mark on the glass to preserve the register. Everything in the boat—instruments, punting-poles, tackle, clothes—

all became as white as chalk, or looked as if they had been dusted with flour. The drops of water which fell from the punting-poles were converted into rods of salt, which looked like stearine candles. No wonder this lake was as sterile as the Dead Sea.

When we reached the southern shore it was rapidly growing dark. But there was not the slightest sign of the caravan to be seen. Accordingly we had no alternative but to spend the night on the desolate shore without either food or water, and the only shelter we could find was the two halves of the English boat. Kutchuk, the boatman, turned one-half of the little boat over me as though it were a bell-glass: and in that way I slept, although my narrow domicile reminded me forcibly of a coffin, more especially as Kutchuk heaped up the sand all round the edges to keep out the draught. It came on to snow; but we cared little for that, though the big flakes pattered on the oil-skin covering of the boat like so many tiny spirits of the air trying to get in to us.

The next day, aided by favourable winds, we sailed to the west, and found that the caravan had been stopped in its march by a stream, 160 feet wide and 10 feet deep, and had consequently encamped on its northern bank. We raked together everything which in any way partook of the nature of a rope, tied them all together, and stretched them across the river between two firmly fixed camel ladders, and in that way conveyed the baggage across in thirteen instalments. The horses swam over of their own accord, but the camels were troublesome. They refused to budge an inch, wouldn't lift a foot, and lay down composedly in the middle of the stream, and even left us to hold their heads above water with stout ropes. In the meantime my little collapsible boat, which in itself made a fourth part of a camel's load, was of great assistance to us in conveying over the rest of the caravan. The river which caused this obstruction flowed out of a fresh-water lake, fed by swift glacier torrents, and, at the time of which I speak, was carrying down 1625 cubic feet of water per second.

As we travelled on towards the south, our provisions began to give out, and there was only ammunition enough for Aldat the hunter's Asiatic gun. At camp No. 36, where there was fair pasture, I gave the camels a nine-days' rest. Meanwhile I, with some of the better-conditioned horses and three men, made an excursion to the south-east, to examine and map a highly peculiar lake-region, where water was more plentiful than dry land. Two large fresh-water lakes, extending from west to east, gather up several streams and brooks from over a very considerable area, and give off another broad stream which enters a salt lake situated farther northwards.

On the northern shore of the eastern lake red sandstone cliffs plunge sheer down into the water. Here we fished one morning with great success; and, whilst the other members of the caravan marched round the lake, Kutchuk and I measured its depth, and found it to be 157½ feet. I now decided to make for the west and the north, and to cross the mountain chains which we had climbed over on our way south, and so return to Temirlik. While the caravan under the direction of Turdu Bai turned towards the north, I, accompanied by Cherdon and

Aldat, rode towards the south-west, to examine a snow-covered mountain knot which I saw in that direction, and four days later we rejoined the rest. After this, on the second day, we pitched our tents at the highest elevation I have ever encamped in Asia or elsewhere. The hypsometers and aneroids registered 15·2 inches; consequently we were half way through the atmospheric envelope which surrounds the earth.

On September 14, at our fiftieth camping-place, we encountered a snowstorm, the equal of which I have hardly ever seen even in the Alai valley. The snow simply came down in sheets, and was driven by the wind into snow-wreaths with amazing rapidity, so that in a few minutes my tent was surrounded by a high, thick wall; and it was impossible to obtain either firewood or pasture for the animals. Here again the surface consisted of nothing but pure mud; but as it froze sharply at night, the ground was hard in the morning.

At last, however, but again in the midst of a raging snowstorm, we once more crossed the Arka-tagh, and encamped on the western side of the lake of Atchik-köll. On October 6, still going north, we crossed over a pass in the mountain chain which forms the northern boundary of the basin of Atchik-köll. The cold was intense, and here again we had to contend with a violent snowstorm. Five horses succumbed on the summit of the pass. There was not a blade of grass to be had, not even so much as moss. After that our route still lay northwards through the well-defined valley of Fogri-Sai, fenced in by granite escarpments. In this region we chanced upon a so-called *kan*, or deposit of gold, which, however, was deserted for the autumn and winter. I also found at a spot where the valley begins to open out an interesting carving, representing a tiger, yak, and antelope hunt. It was of considerable antiquity, for the hunters were depicted as using crossbows. Another discovery in the same region was an *obo*, or religious stone monument erected by Mongolian pilgrims, and inscribed with the Buddhist formula of prayer, "On maneh padmeh hum." Here also we fortunately fell in with a couple of yak-hunters, whom I sent on to our principal camp with a message asking for assistance. After losing two or three more camels and horses, we at length struck the broad valley of Chimen, and pushed up it at an increased speed, doing up to 26½ miles in a day. On October 16 we caught a glimpse of a fire in the far distance—to us, who for three months had not seen the face of any human being except ourselves, a most welcome sight. But although we pressed on until midnight, we were unable to reach it, and, thoroughly done up, were compelled to encamp where we were. It was Islam Bai, who perceived us the next morning, and soon after met us with fifteen horses laden with provisions. This was on October 16. Four days later our wanderings came to an end; we entered the headquarters camp, Temirlik, and were once more at home.

My next expedition was one of twenty-five days' duration, its object the exploration of the mountain chains which shut in the valley of Chimen on the north and on the south, as well as to take soundings in the lake of Kum-köll. Accordingly we crossed the Chimen-tagh, and the Kalta-Alagan mountains to the shores of the salt lake, upon which I

spent two days boating. We found that the greatest depth of the Kum-köll was 75½ feet.

My journeys were not, however, yet at an end; for on December 12, 1900, I again left Temirlik with an escort of nine men, eleven camels, ten horses, and three dogs. After paying a visit to the salt lake of Gas-nur, we struck up through a valley in the Akato-tagh. At the top we encountered a difficult pass, where steps had literally to be hewn out and the camels assisted over one by one. We then continued our march between the parallel chains of the Astyn-tagh, where we came upon traces of an ancient Mongol road. On the first day of the new century we reached Anam-baruin-gol, and after spending twenty days in marching round the vast mountain knot of Anambar-ula, wound up by visiting the Sirting Mongols, who gave us a friendly reception and replenished our stock of provisions. The temperature now sank to 25½° below zero (Fahr.), which would not have mattered much had the wind not blown with such steady persistency.

From Anam-baruin-gol I sent back two men and seven horses to Charkhlik, our next rendezvous. I did not think I could take more than three horses with me across the desert, and consequently ordered the rest of the men, at the end of forty-five days, to be on the northern shore of Lake Kara-koshun, three days' journey north-east of Kum-chappgan, with fresh horses and provisions, and my letters. And I directed them to guide us through the desert by setting fire to the reed-beds in the lake every evening. On January 27, taking with me the remainder of the caravan, I left Anambar and crossed the Gobi desert west of Sa-chow, a journey of ten days, to the well of Tograk-kukuk, situated on the desert route between Abdal and Sa-chow. On the way we passed through several different kinds of country—steppes, low mountains, complete sandy desert, with sand-dunes of considerable altitude, and finally steppes again.

The little oasis of Tograk-kuduk was then made the starting-point of a dangerous but interesting journey. We took with us ice to last twelve days, for ourselves and the horses; and, as it turned out, it was precisely the quantity that was needed. Our camels were just beginning to feel the want of water, but on the whole bore the journey well. We marched northwards, at the rate of 20 to 25 miles a day, mostly over wretched *usar* (eskirs) and ridges, scarce big enough to be called mountains. They were, however, greatly weathered, and the country utterly barren and desolate, without a drop of water anywhere.

On February 18 came the first buran of the year: and it was so bitterly cold that we had to go on foot to prevent ourselves from being frozen to death. At night we were only able to make a little tea at the cost of two of the tent-poles with which to make the fire. On the 19th the storm still continued to rage; but as we had no firewood of any description whatever, we were obliged to content ourselves with sucking small pieces of ice and munching dry bread—hardly a fitting repast for such truly arctic weather as we were then experiencing. The tracks of wild camel were exceptionally frequent, and I observed them with the greatest interest, and noted them down on my map-sheet: they might later on

point to important conclusions. Our situation was now critical. Our stock of ice was exhausted, and the camels had not drunk a drop of water for twelve days. Fortunately that same evening we reached a spot where the wild-camel tracks all converged into one common track, which eventually led into a valley, in the beginning of which, sure enough, there was a salt-well, surrounded by a belt of fresh-water ice, a few inches thick. As fuel also was to be had in the same place, we stayed there two days, the camels, meanwhile, quenching their thirst by crunching the ice, which we hewed to pieces for them.

On March 2, in a dense fog, we approached the oasis of Altinish-bulak. I discovered that I was just under two miles out of my reckoning, which was not so very bad, considering that my route was determined by upwards of 10,000 compass observations, extending over a distance of more than 1300 miles. Leaving behind at the oasis three weak camels and all the horses, in charge of one man, I took with me the rest of the caravan, and sufficient ice to last for a week, and set out to visit the ruins which I had noticed the previous year. We reached the place at the end of the third day, and made a stationary camp in the vicinity of a big tower, constructed of burnt and sun-dried bricks. Our investigations resulted in the discovery of a small village of nineteen houses, which I carefully surveyed, and then had dug out. Our finds embraced a lamp, some Chinese money, several small articles, the wheel of an *arba*, or Turkestan cart, various kinds of utensils, pottery, and wood-carvings, which had been used to decorate the houses, etc. In the village which Ordek had discovered the previous year we found and examined a small Buddhist shrine, which must at one time have been beautifully ornamented. The interior of the shrine contained an image of Buddha enthroned. Its dilapidated trunk is also included in my collection. While the excavations were in progress, a small piece of wood was flung aside as being of no value; but I picked it up, and found it covered with native hieroglyphics, which the savants have not yet succeeded in deciphering. On the north the shrine seems to have been protected by poplar woods, but towards the south it looked out over the thick reed-beds which fringed the ancient lake of Lop-nor. On one piece of timber, by the way, there was, amongst other objects, a fish depicted.

The brick tower which I just now mentioned was 29½ feet high, and afforded an excellent view over the desert. I wondered whether it was in any way akin to the *stupas* which are found near Kashgar, and tried to dig through it. But there was nothing in its interior. It was probably a watch-tower, or signal-tower, in times of war, fires being kindled at its corners.

We discovered three other similar towers, and four villages altogether. It is of importance to remember that all these ancient habitations lay on a line which ran from the north-north-west to the south-south-east, and which, consequently, coincided with a great high-road that led along the northern shore of the lake. In two or three of the houses there were large quantities of fish bones, of the same species as those which now live in the Kara-koshun. Amongst other things we also found wheat and rice, and parts of the skeletons of sheep.

In another of the houses, built of sun-dried brick, and resembling a stable more than anything else, we came upon a large quantity of papers and letters written over with Chinese writing. This was a grand discovery. These ancient documents would throw a flood of light upon the history of the place. We prosecuted our labours with double zeal. But these were the only manuscripts we found, and they lay buried under two feet of sand. In the same place, however, we dug out forty-two small, narrow wooden wands, also written over with the same kind of writing. On my return home I sent these materials to the learned sinologue, Prof. Himly, at Wiesbaden, who is now deciphering them. As soon as he had made a preliminary examination of them, Prof. Himly wrote saying that the data and other indications pointed to a period between the middle of the third and the beginning of the fourth century A.D. "The objects themselves appear to have belonged to a wealthy Chinese merchant, who supplied commodities of every description, let out carriages and beasts of burden on hire, besides conveying letters to Tun-kwang, *i.e.* Sa-chow. Travellers going to the latter city used horses, carriages, and even oxen. One of the documents appears to contain an allusion to a military campaign, but it gives no indication of date. Amongst the geographical names mentioned we find the very one which designates the country here in question, viz. Lou-lan. The inhabitants must also have been engaged in agriculture, for one of the principal items in the manuscripts consists of weights and measures of seed-corn; some of them also name this or the other kind of corn. Possibly there once stood on the site where the manuscripts were found an old revenue office, or a sort of 'grain-bank,' where grain was bought and stored, or received as security for loans advanced. The papers exhibit one strange peculiarity, in being written on on both sides—a practice which does not now obtain in China either in writing or in printing."

"In any case, the collection of manuscripts which you have brought home with you is one of great interest, even to the Chinese, and will unquestionably form the subject of scientific speculation for some time to come. Some of the sheets are nothing more than simple exercises in writing; others consist of fragments only. But in both cases the style of writing differs but little from that which is now in use in China. The wooden wands have this advantage over the paper manuscripts, that each contains one or more complete sentences; as, for example, an antelope is delivered, such-and-such a quantity of seed-corn has been handed in, or so many men have been furnished with provisions for a month, or longer. To judge from one passage, the official who lived at this place would seem to have governed a pretty large province. The passage runs thus: 'The approaching army is to be met at the frontier (or the shore?) by forty officials, and the farmsteads are many.' He seems also to have had two native chieftains in close dependence upon him. The majority of the dates in the manuscripts fall between the years 264 and 270 A.D. In 265 the emperor Yüan-te of the Wei dynasty died, and was succeeded in the north of China by Wu-te of the Tsin dynasty, who died in 270. Most of the copper coins that are legible are what are known as *wu-chu* pieces, a variety which was struck between 118 B.C. and 581 A.D.

Numerous other pieces belong to the *kwo-tsian* mintage, which goes back to Wang-mang, who held the reins of power between 9 and 23 A.D. Thus the dates on the coins agree fully with the indications of date conveyed by the letters and the wooden wands."

These few observations by Prof. Himly, on his first cursory examination of the materials which I have brought home with me, will serve to indicate the value of the information which I have been instrumental in unearthing from the sands of the great desert of Central Asia. For one thing, they throw unsuspected light upon the physical and political geography of the interior of Asia during the first centuries after Christ, and show what prodigious changes have taken place in that part of the world during the last fifteen hundred years. The name Lou-lan occurs in the writings of Edrisi, and a learned mandarin in Kashgar, to whom I showed the manuscripts, told me that, according to the old Chinese geographies, the country round the present Pityan, near Turfan, was formerly called Lo-lan. Read in connection with the physico-geographical investigations which I have made into the movements of the lake of Lop-nor, these historical data are of inestimable value. Not only do they give us information about the country of Lou-lan on the northern shore of the ancient Lop-nor, but they also throw light upon several unsolved problems connected with the region which lies half way between China and the countries of Europe. They tell us there was a regular post between Lop-nor and Sa-chow, and, consequently, there must have been a route of regular communication through the desert of Gobi. The ancient road which ran from Korla, alongside the Concheh-daria, where I previously discovered a chain of brick towers (*pao-tais*), as well as the fort of Merdek-shahr, acquire an entirely new importance in the light of these more recent facts. Numerous ruins exist also at Yin-pen, another important station on that same highway.

The question of agriculture having been followed in ancient times in Lou-lan, is one of very great interest. How was it possible to carry it on? Not one rivulet flows down from the Kurruk-tagh mountains; not one drop of rain ever falls from the sky. Canals, or irrigation *ariks*, similar to those which are found all over Eastern Turkestan at the present day, must have been made from the river which flowed into Lop-nor. The grain-banks spoken of still exist in every town in Eastern Turkestan, under the control of the Chinese authorities, and serve the purpose of securing an equal distribution of bread amongst the natives. True, I unearthed four villages only, one of them consisting of not more than nineteen houses; but there is no reason why the desert should not yet yield many other valuable archæological remains. The mention of forty officials, a military expedition, and many farms, points to the inference that Lou-lan was a well-peopled region. Possibly the people dwelt in perishable reed-huts, as they do at the present day. Time, however, will not permit me to linger longer on this interesting subject. I must return to my journeyings. As soon as I arrived at the ruins, I sent the camels back to Altinish-bulak, to get pasture and fetch ice. Upon their return, at the end of a week, we broke up camp, and marched southwards,

beginning what turned out to be a most interesting and instructive journey across the desert. My own party consisted of one Cossack, three Mussulmans, and four camels. The rest I sent, under the command of Faysulla, who had accompanied me the year before, to the south-west, with instructions to try and get to Kumchappgan. In this, however, they failed, being stopped by vast sheets of water of quite recent formation, so that they were driven as far west as the Tarim. And I was consumed with anxiety about them until I learned they were still alive, though they lost all their horses and ran short of supplies. Meanwhile, we in our party had a difficult and tedious task to perform, namely, to take exact instrumental measurements for determining the slope of the desert from north to south; that is to say, from the northern bank of the ancient Lop-nor to the northern shore of the existing lake of Karakoshun. The contours of the region were, however, peculiarly favourable for our purpose, being as level as the sea, except for the furrows scooped out by the wind, so that I was able to continue my measurements in a direct line, without hindrance. The distances between the levelling instrument and the staff were taken with the tape, and the total distance worked out at 50½ miles. This cost us eight long days' work, and, of course, obliged us all to go on foot; but we took four camels with us, chiefly to carry ice.

On the very first day we had an adventure which might have proved disastrous. I myself started early, with my assistants and my levelling instruments, after giving orders to one of the men to follow on with the camels a couple of hours later, make a *détour* round us, and then meet us at the appointed camping-ground. One of the camels carried, amongst other things, all my maps and note-books. We worked on all day, and measured 5 miles and 1196 yards, and in that distance there was a fall of only 7½ inches. When darkness set in the caravan was nowhere to be seen, and we made a big signal-fire at the edge of the dead forest, which happened just there to come to an end. Shagdur set out to hunt for the caravan. If it had missed us it was doomed, and our situation, too, would be very critical, for we had not one drop of water with us. But, fortunately, our signal-fire was visible at a great distance, and the camel-driver turned up in the course of the evening with everything all right.

That same night a storm got up in the east, and compelled us to strike work for the whole of the next day. But Shagdur had not returned. However, as he was provided with a compass, and was quite familiar with my methods of mapping, I had not the slightest anxiety on his account. As it turned out, he did take the precaution of noting his compass bearings the moment he left the camp, and during the course of the next day he turned up all right. This I regard as a triumph of native intelligence, seeing that the region was perfectly flat, without any distinctions of contour, and a violent storm, accompanied by an impenetrable fog, was raging all the time.

As soon as the storm subsided we continued our levelling operations, and by the end of another day had descended 8 feet 2½ inches. In fact, we crossed over a depression which lies 26¼ feet below the level of our

point of departure. During the two following days we again ascended 10 feet 10 inches, but during the last three days once more descended something like 10 feet. The result of the cubic measurement showed that the surface of Kara-koshun lay 7 feet 5½ inches below our point of departure on the northern shore of the ancient lake of Lop-nor. At the same time, it must not be forgotten that, during a great part of the second and third days, we were down below the present level of Kara-koshun, and that our camp on the second day of our operations was pitched 8 feet 8½ inches below the point of departure. Without stopping to analyse exhaustively the results of this remarkable survey of over 50 miles, I will only pause to observe that it proves in the most conclusive way the existence in the northern part of the Lop desert of a depression with a depth precisely similar to that which I sounded in Kara-koshun.

Upon reaching the northern shore of this latter lake, our labours came to an end, and our next step was to hasten back to Charkhilk, where the main body of the caravan was supposed to be encamped. I had instructed Tokta Ahun, one of my men, to go three days north-east of Kum-chappgan and there light signal-fires for our guidance. But as we were unable to see these, and the country grew perfectly barren as we approached the lake, I sent on Khoda Kullu, another of my men, westwards, on foot to look for them, and guide them to us the moment he found them. But for several days nothing more was heard of him, and as, in the meantime, we were reduced to a few ducks which Shagdur managed to shoot, I resolved to follow after Khoda Kullu. But after going one day's journey along the lake-shore, we were stopped by a vast sheet of water, stretching towards the north-east, which we could neither see across nor get across. Just when we were becoming hopelessly entangled amid this labyrinth of waters, we perceived three horsemen coming galloping from the north-east. The riders were my faithful Cossack Chernoff, Tokta Ahun, and Khoda Kullu, the man I sent out in search of the caravan. The latter, it appeared, had travelled for five days before reaching the encampment, and when he did arrive he was half dead with hunger. Now, strange to say, the encampment he went in quest of was all this while not more than two miles distant from our own, and had there not prevailed a dense fog during the whole of this time, we assuredly should not have missed seeing their signal-fires. It will appear almost incredible that Khoda Kulla should have taken five days to ride a matter of only two miles, but the fact was there lay between the two camps a newly-formed arm of the river, flowing with a volume of upwards of 1130 cubic feet of water in the second. We ourselves were hemmed in on both sides by this stream. As the water flowed northwards at a prodigious rate, forming a new lake as it went, it took us four days to get round it. It had cost the mounted men three days' hard riding to reach us, and as we returned we found their horses' hoof-marks already under water, in some places at a depth of 18 inches. Indeed, the water bubbled and boiled along at such a rate, and over such a wide stretch of country, that it was dangerous to encamp anywhere near its margin. Consequently we

were obliged to travel half way back to the ruined villages before we could turn to the west. After that we bent round to the south, until, finally, we reached the caravan encampment, and found there everything we needed.

The lake of Kara-koshun, which is thus gradually disappearing in the place where Prjevalsky found it, is slowly creeping northwards, seeking to return to its ancient bed, where, I am perfectly convinced, it will be found at no great distance of time.

That such great changes as these are able to take place in this part of the world, which my measurements have shown to be almost perfectly horizontal, is not at all surprising. The lake of Kara-koshun, which has occupied its present situation for a very long period, is getting choked with mud and drift-sand and decaying vegetable matter; while, on the other hand, the northern part of the desiccated desert is being eroded and furrowed by the winds, and is thus growing deeper and deeper every year. The basin which serves as the terminal reservoir of the Tarim system must necessarily be extremely sensitive to these changes of level, determined as they are by purely mechanical laws and atmospheric depression of a strictly local character. It is simply a physical necessity that the water of that reservoir must ultimately overflow its basin and seek a relatively lower level. Thus a drop of some three or four feet in level is sufficient to cause, through the action of the wind, a total transformation in the map of the district. As the lake moves, so do the vegetation and the various animals of the desert. They, as well as the fisher-folk, with their reed huts, follow after to the new shores, while the old lake gradually dries up. In the far-off future the same phenomena will recur again, but in the reverse order, though the natural laws which will effect the reversal will remain precisely the same. Whenever that occurs we shall be in a position to determine, on the basis of a more complete accumulation of data, what is the length of time required for these periodic movements. This, however, we do know already, with perfect certainty, that in the year 265 A.D., the last year of the reign of the emperor Yüan-te, the lake of Lop-nor lay in the northern part of the desert. Lop-nor is, as it were, the oscillating pendulum of the Tarim river, and even though each oscillation extends over a space of a thousand years or more, yet, measured by the clock of geological time, we know that such periods are of no more account than so many seconds of *our* time.

After the completion of this journey, I pitched my camp at the little town of Charkhlik, on the edge of the desert, and gave myself a month's much-needed rest. Meanwhile, however, I organised and equipped the largest caravan I have ever led into unknown regions. It comprised thirty Mussulmans, four Cossacks, one Mongolian lama from Kara-Shahr, thirty-nine camels, forty-five horses and mules, seventy asses, fifty sheep, and eight dogs.

I sent on the caravan, under the command of two of the Cossacks, by well-known trails over the mountains which run along the northern boundary of Tibet, and so up on to the great plateau of that country. I myself, taking with me the other two Cossacks and some of the horses,

rode up by the bed of the little river Charkhlik, a most disagreeable road, encumbered as it was with loose stones. One day we crossed the stream no less than sixteen times, getting several wettings in doing so, but we did not lose anything except one horse load of supplies. Finally, after an instructive journey over many difficult passes, we reached the western shores of the lake of Kum-köll, the appointed rendezvous.

My plan was to march on southwards until we reached a region with tolerable pasture, and there establish a fixed camp as a basis from which to carry on further operations. But a difficult piece of country still lay between us and the Arka-tagh, the highest mountain range on the face of the earth. The ground was soft and gave way under the animals' feet, and we got entangled in a bewildering labyrinth of exasperating small hill ranges, where we were again and again obliged to turn back and retrace our steps. Every day I sent on pioneers in advance to reconnoitre and find out the best route for the caravan to take. In one place we lost thirteen asses, in another nine: but we saved their loads, and packed them on the horses, though not before we had cut them down considerably. Upon reaching the foothills which stretch in front of the mighty chains that form the Arka-tagh mountains, we rested a couple of days to reconnoitre and search for a pass. Here the animals got the last bite of pasture they ate for a long, long time.

From our last encampment on the north side of the Arka-tagh I sent home ten men and such of the asses as survived, and then continued my march over the repellent mountains which, in my experience, have always been so formidable to surmount. We made our way up through sterile valleys littered with gravel, battered every day by violent storms of snow and hail and rain. In this way the animals' strength became more and more exhausted in proportion as their burdens were made heavier and heavier.

The final slope up to the summit was extremely precipitous, and we were repeatedly brought to a standstill by the exhausted camels. The snow lay deep all around, and a howling snowstorm made it impossible to see the road in front of us.

Once over the pass of the Arka-tagh, we pushed on south through an absolutely unknown region, where we crossed innumerable mountain chains, over passes of stupendous height, skirted the shores of innumerable lakes, and forded innumerable rivers, but almost the whole time through a barren country, totally devoid of grass, so that every day the caravan animals grew more emaciated. We continued to shoot yaks, wild asses, and antelopes, and consequently were in no want of meat. The Cossacks also kept the camp supplied with partridges and wild geese.

The same parallelism in the mountain ranges which prevails throughout the whole of higher Asia characterises the region of which I am now speaking—that is to say, the chains run from west to east, and as we were travelling from north to south, we had consequently to cross over every one of them.

At camp No. 32 I weeded out the twelve worst camels, besides a number of inferior horses, and left them to follow on after us at a slower pace, under the charge of the Cossack Chernoff and four Mussulmans.

Then, taking with me the rest of the caravan, I pushed on all the faster towards the south.

As camp No. 38 yielded a bit of tolerable pasture, we stayed there two or three days to rest. Whilst we were there the Cossacks chanced to catch sight of a bear, and whilst following him up came upon a Tibetan encampment of three men, with horses and yaks. The Cossacks hurried back to bring the news to me ; and I at once sent them back again, with the lama to act as interpreter, to glean some information about the region we were in. But when they reached the place the Tibetans were gone, and our horses were not in a good enough condition to admit of our following them.

We learned afterwards that the Tibetan hunters posted off southwards and told the nearest native chiefs that an army of Russians was approaching from the north. Hence our arrival was known long before we suspected it, and a sharp look-out was being kept throughout the country north of Lassa and along all the roads which led to that mystic city. I strongly suspected that this encounter with the Tibetan hunters would bode us no good. Accordingly, when we found there was very good pasture at camp No. 44, besides traces of recent nomad encampments in the neighbourhood, I decided to make that my main camp or base for further expeditions. At the same time I made haste to complete my Mongolian equipment, and after having made quite sure of the position of the camp by astronomical determination, on July 27 I started for the south, accompanied by the Buriat Cossack Shagdur and the Mongolian lama. I left Sirkin in charge of the camp, with instructions to move on to some other place as soon as the pasture was done, and when *that* was finished to move on again to a third place, and so on. But he was always to leave behind him in every encampment a report of what he was going to do, so that I might be able to follow up the caravan. My Mongolian equipment was very simple ; it consisted of two small cases, a tent, provisions for a few days, some Chinese silver, and a few surplus furs, everything being of Mongolian manufacture. We lived also in genuine Mongolian fashion. However, I also took with me a few small note-books, an aneroid barometer, a thermometer, compass, and chronometer, so as not to be obliged to discontinue my observations. Those whom I left behind looked upon the undertaking as a piece of madness, and thought that surely I had taken leave of my senses. For the first two days Ördek accompanied us, to keep watch upon our animals at night, so that for at any rate two nights we might sleep in peace. The animals we had with us were five mules and four horses. At the end of our second day's ride, or when we had left the camp 46 miles behind us, I had my head shaved as bare as a billiard ball, and my moustache cut off altogether. I looked horrible ; but then I was something like a genuine Mongol, especially after the lama had for several days smeared my face with grease, till I was partly black and partly brown. We were all in good spirits. Our tent was pitched on a neck of land between two lakes, one salt, the other fresh, and the horses and mules, guarded by Ördek, were peacefully grazing a short distance away. About midnight Ördek came

rushing into the tent, and woke us up with the cry of "Robbers! Robbers!" We snatched up our rifles and revolvers and hurried out, but the dim moonlight was barely sufficient to show us some mounted men hurrying away over the nearest hills, taking with them two of our horses. All thought of pursuit was, of course, out of the question, because, for aught we knew, our camp might even then be surrounded by a whole band of thieves. We therefore sat round the fire and talked till daylight, when we struck camp and travelled on farther towards the south-east. Poor Ördek had to trudge the 46 miles back to camp on foot. My men there looked upon us as lost for good and all. But I left instructions with the Cossacks that, if I did not return within three months, they were to make for Kashgar and report. On the third day we made a long march, and in the evening perceived some Tibetan horsemen keeping a watch upon our movements from a distance. From this time onward we made it a practice to divide the night into three watches of three hours each, so that each of us had his three hours to do sentry-go. Fortunately we had two first-rate helpers in Yollbars and Malenki, the two biggest and fiercest dogs my caravan possessed. And we always pitched our tent so that the animals were tethered on the side that was against the wind, for it was from that quarter that night visitors might be expected, and the dogs were tied up one at each end of the camp-line. Never shall I forget those interminably long night-watches, when I tramped backwards and forwards between Yollbars and Malenki listening to every sound, even the least suspicious. I had not the slightest difficulty in keeping awake; any moment we might be suddenly fallen upon. Many and many a time the dogs set up a fearful barking. Thereupon I would hear a noise in a certain direction, and would creep towards it, revolver in hand. Then the dogs would stop barking, and everything become still again.

Our fourth day's march led through uninhabited and very hilly country. It rained in torrents both day and night without once ceasing. I confess I never saw such rain.

On the fifth day of our march we did a very long ride, passing on the way a caravan of Mongolian pilgrims. Late at night we came to a black tent, the owner of which, Sampo Singhi, a shepherd, gave us a friendly reception, and sold us a sheep, which he suffocated by holding his fingers in its nostrils. He also gave us cream and sour milk, so that for the next few days we fared quite sumptuously. In the course of the following day's march we forded the river Satyu-sangpo, at that time tremendously swollen by the rains. It was the worst fording of a river I have ever experienced. The water in its deepest part came up to the pommel of the saddle, and little more than our horse's head and neck was visible above the raging flood.

The next day, the seventh of our journey, we crossed a wide, open expanse, bounded in the far distance by a range of low mountains, and overtook a caravan of three hundred yaks, led by thirty Tibetans, and laden with Chinese tea for Tashi-lunpo on the Bramahputra.

The eighth day carried us over a couple of very high passes, beyond the second of which we entered a region fairly well peopled with

nomads; their black tents dotted the clefts and slopes of all the mountains in the vicinity. The next evening we pitched our tent in a sort of corrie beside a brook, and had to the south of us the mountains which overhang Tengri-nor on the north. We had now travelled a distance of 180 miles from our main camp. Thus far were we destined to go, but no further. For just before it got quite dark we were surrounded by Tibetans, who announced that we were their prisoners, and that one step further would cost us our lives. Our lama was in a panic of terror, and believed we should be instantly slain. We accordingly halted, and awaited passively the progress of events. Thirty-seven sentinels were posted round our tent. We saw the Tibetans' fires through the mist in every direction, but more especially on the road towards Lassa. The next day, too, we kept tolerably quiet upon perceiving a band of fifty-three mounted men, armed with long black muskets, swords, pikes, and lances, spring up like mushrooms out of the ground, and gallop in extended order towards our tent. Uttering a string of the wildest yells, or war-whoops, they charged straight down upon us, but, swinging off to both sides, drove on past, then wheeled round, and came back again like a hurricane, flourishing their pikes over their heads. After that they pitched their tents close to ours, and began to shoot. This they did, it would seem, to inspire us with respect. Our impression was, that, if they intended to take our lives in a polite manner, it was scarcely necessary to levy so many people to do it.

After a while this later band arranged themselves in little troops, and rode off in the direction from which we had come. They were all dressed in black and red cloaks; the officers wore big white hats, while the remainder had red bands round their heads. As a rule, however, the Tibetans go bareheaded, and never have their hair either combed or cut.

Meanwhile we were treated with the greatest friendliness by the first-comers. An old lama assured us that we had nothing whatever to fear; the Dalai Lama had given orders that we should be treated with the greatest consideration, and that all we needed in the way of provisions should be provided us free of cost. Accordingly they brought us milk, butter, and lard in their bowls, and presented us with more mutton and firewood than we knew what to do with, nor would they accept any kind of payment whatsoever in return. In the course of a few days, he said the "bombo," or governor, of the province of Naktchu would arrive, and then we should know our fate. And in due time the said high official put in his appearance, and we soon saw a large village of white and blue tents spring up alongside the road to Lassa. Through his interpreter, who spoke Mongolian, the governor invited me to a grand banquet in his tent, but I answered that if he wished to see me, he was at liberty to pay me a visit. Accordingly, in the course of the afternoon, we perceived a crowd of horsemen gallop out from amongst the tents and ride towards us. They consisted of Kamba-Bombo, governor of Naktchu, and Nanso Lama, accompanied by several other dignitaries, besides officers and soldiers armed as if for a campaign—

sixty-seven of them in all, each man mounted and dressed in handsome ceremonial robes. I question whether they ever clearly understood who I was; but seeing the pomp and ceremony they assumed, it was evident they imagined somebody out of the common was disguised beneath my tattered Mongolian garb. Kamba-Bombo rode first, surrounded by his staff. He wore a costume of yellow silk, had on a red head-dress and Mongol boots of green velvet, and was mounted on a big grey mule, with a costly saddle, and had his saddle-cloth embroidered with silver and turquoises. He dismounted, and, followed by a throng of his officers, greeted me politely, and, stepping into our wretched tent, took his seat on a bag of maize.

All these men carried swords, suspended from richly chased silver belts, ornamented with corals and rubies. They wore, further, *gaos* (or talisman cases) round their necks, and were adorned with rings, bracelets, and other finery, and had their hats trimmed with feathers. My honest lama was completely overcome by all this magnificence, and kept his eyes the whole time fixed on the ground.

Meanwhile Kamba-Bombo was in the very best humour, now that he had us completely in his power, and declared categorically that, no matter who we were, we must retrace our steps if we did not wish to have our heads cut off, at the same time drawing his hand significantly across his throat. I found it was perfectly useless to argue with him; he had imperative orders from the Dalai Lama. Thereupon he presented me with a couple of horses, a flock of sheep, and some provisions —gifts of priceless value, which, however, I was totally unable to return—and appointed an escort of three officers and twenty men to accompany us as far as the river Satyu-Sangpo on our way back. With these men we were soon on the most friendly footing, so that when they left us we felt quite melancholy.

At last, on August 20, we reached our main camp, thankful that we were still safe and whole in life and limb. For, although we had not had the good fortune to reach the "Holy City," we comforted ourselves with the thought that we had done our utmost to get there, even to the extent of risking our lives for that object.

With the full strength of my caravan once more behind me, I proceeded southwards by a different route, being firmly resolved not to turn to the west until I should be compelled to do so by absolutely insurmountable obstacles. But we did not get very far before we once more had the Tibetans upon us. They sprang up on every side, their numbers increased, and they rode in close-ordered troops on both flanks of our caravan; then they disappeared, and anon reappeared, racing past us at full gallop.

With these bands we lived upon a sort of war-footing, and every night posted strong guards or outposts round our camp. We were but scantily supplied with ammunition; but luckily shots were not exchanged. When we showed signs of continuing our journey, the Tibetans sent a deputation to me, begging me, in touching terms, not to proceed further. When they found their request was unheeded,

they hurriedly despatched couriers to Lassa. Meanwhile we proceeded on our way.

Eventually Hadyeh Tsering and Yunduk Tsering, two of the Dalai Lama's ministers or members of his *devashung* (or council) in Lassa, came direct from the Holy City, bringing with them five hundred mounted men, and against such a force I had no inclination to declare war. These officials read to me a proclamation from the Dalai Lama, which, amongst other things, contained the following passage: "Let letters be sent with all speed to Namsu and Naktsang, that no Russian can have permission to travel on any of the roads of Naktchu and inwards as far as my kingdom extends. Let letters be sent to all the chieftains. Watch the frontiers of Naktsang. It is absolutely essential to guard strictly every part of the country. It is entirely unnecessary that any European shall enter into the kingdom of the holy books and spy out the land. In your provinces they have nothing whatsoever to do. If they say they have, then know they must not travel to Lassa. And if they do travel, then shall you lose your head. See to it that they turn back by the way they came."

Autumn was now approaching, and we had a long way to go to reach Ladak. Nevertheless, I stayed where I was until I had mapped Naktsang-tso and Selling-tso. Thus for ten days longer we were honoured with the company of our Tibetan escort, though we lived on the best of terms with its leaders. We visited one another every day, and they arranged a *jikitorku* in my honour, gave me horses and sheep, and throughout treated me with the utmost politeness. Our united camps presented an imposing spectacle, with their streets of tents, their innumerable fires, their troops of horses and horsemen. While my caravan, escorted by the Tibetans, marched from the eastern shore of the lake of Chargut-tso, round by the northern shore, I and Kutchuk the boatman crossed it by boat to take soundings, the arrangement being that the caravan was to look out for us at the western extremity of the lake. But a more disagreeable voyage it has never been my lot to participate in. When the caravan had disappeared behind the mountains which shut in the lake on the north, and we were far out on the water, we were overtaken by a violent westerly storm, and it was only by dint of the very greatest exertions that we managed to reach a tiny rocky islet: and there we were kept prisoners for forty-eight hours. At last the tempest subsided, and we continued our voyage by night, I making my soundings by moonlight, with the aid of a lantern. Next morning the storm broke out afresh, and we again took refuge on a similar rocky islet. In the afternoon of the same day we once more started, but only just managed to reach the western shore, through having to battle for our very lives with a third tempest. We only just escaped being wrecked; and, utterly exhausted by our exertions, we slept that night on the desolate lakeside, and after going for one day more, were seen by the men whom the leaders of my own caravan sent out in search of us. On my return to camp I was greeted by the Tibetans with shouts of joy. During my absence they had manifested the utmost uneasiness, and kept incessantly asking the Cossacks where I had gone to. The latter

at length told them I had rowed to the southern side of the lake, had there procured horses, and ridden to Lassa. Instantly they sent out patrols of fifteen to twenty men to ride round the lake, and even go on further to the south. In the meantime I and Kutchuk were quietly smoking our pipes on the tiny islet in the middle of the lake. But now they were convinced I had *not* escaped them, their delight knew no bounds. They met me on horseback and conducted me in triumph to their tents, where, under the protection of their idols of Buddha, and in the light of their oil lamps, I was entertained in the most sumptuous manner.

At this juncture Hadyeh Tsering and Yunduk Tsering, and a great part of their mounted force, took their leave of us. Nevertheless there was still a considerable escort left, and these men remained with us all the way to the frontier of Ladak, although their numbers gradually dwindled, until by the middle of December there were only twelve men left. But by that time they were fully satisfied that I seriously meant to leave their country. Time, however, will not allow of my giving further particulars about this wearisome journey of three months' duration, right through Tibet from east to west. It was a time of severe trial for both man and beast.

By the middle of November there was scarce one-third left of the imposing caravan with which I started from the other side of the Arka-tagh. The country we travelled through was sparsely inhabited by nomad tribes; but we were everywhere received with friendliness and politeness, notwithstanding that almost the whole of Tibet was up in arms because of my attempt to reach the Holy City. I fear I must have caused them a fearful amount of trouble.

On November 19 the thermometer registered 48½ degrees of frost on the Fahrenheit scale. After crossing an uninhabited and almost waterless region, we reached, at the end of the month, the river Tsangarshar, and then followed it down as far as the temple-village of Noh, situated in a beautiful valley, thickly clothed with bushes and other vegetation, so that in the evenings we had magnificent fires to sit round. One day, about this time we lost four out of our five surviving horses, and on another three camels.

After that we travelled for six days along the shores of Tsongombo, one of the most remarkable lakes I have ever seen. It resembles a Norwegian fjord, and is generally only a mile or two wide, though occasionally its width diminishes to less than a quarter of a mile, and in one or two places is actually not more than 20 or 30 yards wide. It is enclosed in a framework of steep and lofty mountains, and presents some magnificent scenery. As it was covered with a sheet of ice, I had to sound it from the frozen surface, over which I was drawn in an improvised sledge, made out of one of the halves of my collapsible boat. Our route took us along the northern shore. In one place the cliffs plunged down into the water so precipitously that it looked for a time as if we should be unable to proceed further. The pass which led over the mountains was impracticable for hoofed animals, and the lake was at this spot quite open water. But the extreme cold

was an ally on our side. We had but to wait for two or three days for the ice to thicken, and then we drew the baggage past the place of danger on an improvised sledge.

After that we skirted along the northern shore of Panggong-tso. This lake formerly belonged to the basin of the Indus, but is now cut off and divided from it by a low pass, which acts as a threshold. Consequently its water is at the present time slightly saline, and the lake free from ice. Its fresh-water molluscs are on the high-road to extinction. Its former beach-lines are, however, wonderfully well defined.

On the frontier of Ladak we found a large relief caravan, sent from Leh to meet us, and here the last of our Tibetan escort turned back home, after having performed their mission in a more than satisfactory way. Then, with two of the Cossacks to bear me company, I pushed on to Leh by forced marches over the passes of Dugub and Jimreh. The temple of Jimreh stands on a shelf, or high cliff, overlooking the valley of the Indus. Here the lamas had no secrets to preserve, but showed me everything, and even took me into the very holiest nooks of their shrines.

I spent my Christmas with the hospitable Herrnhut missionaries in Leh, and on January 1, I was on the road to Calcutta, in response to an invitation by Lord Curzon, Viceroy of India.

A NATURALISTS' SOCIETY AND ITS WORK.[1]

By Professor GEDDES.

How does Nature determine Man, and how far? How and how far can Man redetermine Nature? Nothing is more characteristic of the modern scientific age than that these two great questions are no longer confined to the world of theology and philosophy, or of romance, though, as we see, endlessly debated there, from the child's library to the thinker's. Their contemporary discussion and treatment has taken a more concrete and a more simple form; and for help to read the essential riddle of our own complex life we are turning to seek clues amid the simpler and more concrete evolution of the natural world around us. How far do circumstances shape life? how far are or are not their influences inherited?—such are the questions we are now seeking to solve on the biological plane: and on their approximate solution is at this moment hanging no small share of the educational and social policy of the world's future.

The statesman of the past has been many things by turns; now scholar or historian, again jurist or conqueror, diplomatist, merchant, financier, administrator, and so on; but not yet an applied biologist, at least since Moses' day. But now, after this vast interregnum, we see

[1] An address delivered to the introductory meeting of the Dunfermline Naturalists' Society. *Continued from page* 95.

him beginning to be concerned increasingly with the external circumstances of life; and as bacteriologist, hygienist, and so on, he is coming here and there anew into power. He is rising too from those crude and pre-scientific theories of race which so powerfully affected nineteenth century politics to increasing glimpses, at least, of the actual conditions of human breed and of social selection. Thus, in fact, we are beginning to reach the proposition that both the citizen and the statesman of the future, both the voter and his representative, and these alike in the civic and in the national councils, will before long have to become applied biologists. One cannot for ever either praise the results of individual and international competition or bewail them without any competent first hand knowledge on either side of the struggle for existence; nor always be satisfied either with accepting "competitive examinations" or with denouncing them, without more clear ideas and correspondingly more definite policy also as to how more really to ensure the survival of the fittest.

In summary, then, what the mechanical and physical sciences at present promise and largely perform for the concrete detail of urban craftsmanship, that the biological sciences promise, and will ere long be permitted to perform (1) for rustic industry; (2) for the higher departments of urban industry and commerce: and also (3) for the improved general conduct of civic conditions and of public life.

The transformation of the industry and life of the world through the greater part of the nineteenth century has indeed been determined rather from the side of the mechanical and physical sciences, from Watt to Kelvin, than from the side of the biological. Yet Darwin, Pasteur, Lister express the beginning of a newer movement; one which has gained increasing force even since this present century began, and which will, ere long, be in the first line of interest and importance. Note, for instance, the swiftly progressing movement for the elimination of consumption, hitherto the most formidable and calamitous of all diseases, yet already "one of the most curable," certainly one of the most preventable. Witness again the yet more dramatic solution of the problem of malaria, with its magnificent opening future, from the colonisation of the tropics to the renaissance of Italy—the one so unimaginably vast in its possibilities of colonisation and commerce, the other no less vast in its possibilities of European culture and progress, the former amid those very regions of optimum environment, the latter including those communities of maximum genius which have not only once but again and again determined and dominated the progress of mankind.

Returning from these imperial and international issues once more to our own immediate centre and home, what are its immediate questions, both rustic and urban?—what are they but henceforth more and more biological ones? On the one hand the repopulation of the country and the renaissance of agriculture begin to be realised as urgent and vital; and with this is coming the increasing change of the current urban education, which has hitherto acted entirely towards depopulating the country, for an education which will prepare for remaining there, with renewed interest and skill, with consequent prosperity and pleasure.

Again, in the towns the housing question, the temperance question,

the criminality question, become seen, not as separate problems for rival philanthropists or politicians, but as inseparably interconnected, and as demanding treatment from a point of view far more biological than heretofore. Consider for a moment the outset of this, the biological starting-point of all these difficulties.

Until little more than a hundred years ago our Scottish population was, like that of Norway at present, one of the least urban, one of the most rustic, in civilised Europe; and of the practical outcomes of this, in physical, mental, and moral vigour and productivity in the world, we are sufficiently proud. We see the depth and reality of our long and intimate contact with nature—nature comparatively stern, yet exceptionally varied and beautiful—in our racial variety and individuality, in their outcomes in literature or science. Take, for instance, our vast contribution to the single science of geology, from Hutton and Playfair through Lyell, Murchison, Miller, and their fellows, to the Geikies and their younger rivals and approaching successors.

But in this rich nature-environment, with its essentially rural population, there have swiftly, almost suddenly, arisen the most intense and transforming inventions of the industrial age—the steam-engine and steamship, the hot blast with its colossal outflow of iron, the Forth Bridge with its stupendous mastery of steel. So that about the time we commonly and foolishly reckon our history as a national and characteristic world-unit to have ended, our far larger history and importance had really begun. Every child learns how Dunfermline and Stirling and Edinburgh have each had its turn of being capital of Scotland; but few, too few, know much of its actual capital in Glasgow. Still fewer perceive this as historically the latest initiative world-capital—that of the age of steam and coal, of iron and shipbuilding—and hence with an influence no less far-reaching and profound in its way, than was, in a very different way, of course, that of Florence at the Renaissance. Here the rebirth of human activities has taken a ruder form. The coal age has been but a rude stone age of industry in many ways, even essential ones; and as we call that of our remote forefathers the palæolithic age, so we may now begin to speak of that of our more recent grandsires as the *Palæotechnic* one; and despite that marvellous progress which an older generation almost solely saw, we now feel it has brought new difficulties and evils in its train. So that our Scottish population, despite all its great qualities, its stupendous world-initiatives, has developed correspondingly no less strikingly intense and abundant defects and drawbacks, and these with a world-pre-eminence which we are no longer being permitted to ignore. That we are at this moment the worst housed and the most overcrowded, the most intemperate and the most frequently insane, and appallingly, doubly, triply, the most violent and criminal section of the population of these islands, are so many matters of notorious statistical fact, which no truly patriotic Scotsman can henceforth shirk, especially at this season, when our excellent working Viceroy, for his New Year's message, can but propose to us a correspondingly unparalleled increase of our prison accommodation.[1]

[1] Cf. "Reply of Glasgow Municipality": *Glasgow Herald*, 20th February 1903.

Adequately to bring home this state of things to our national public with its contented vanity, its torpid conscience, will need a new Scottish writer combining the powers of Chalmers with those of Carlyle and Zola; yet the general biological interpretation of it may be considered meanwhile. It is not far to seek; it lies in the profound organic, psychic, and social disturbance involved by suddenly transforming one of the most rural into one of the most urban of modern nations, and in the manifold limitations of the ruder palæotechnic age of industry, with its Cyclops-like might and insistence upon production and its processes, its indifference to environment, its keen interest in the means of livelihood, yet its ruthless insensibility to the value of life. Yet the industrial evolution process has not ended with this widespread, this national degeneracy, this apparent material progress, this real physiological and moral decline. In the very city which has been the historic world centre of both these palæotechnic processes, new processes have begun; and while its leadership with steam-engine or in iron-mastery is no longer so prominent, that of a finer industrial age, which we may call the *Neotechnic*, that of electricity and of art, begins anew. It is significant to note that it was in Glasgow before in Edinburgh that Lister began his world-beneficent labours; while again, in our own day, if it be there that the evils of city life are most intensely developed, it is there too that civic evolution has most distinctly begun—begun with the biological and hygienic problem of the immediate housing of its labouring citizens, and with the return to nature in the purification of its river.

Such are some of the outlooks, both immediate and higher, of a Naturalists' Society: and such is the potential progress of its members, onwards from a freer and happier childhood, filled with the simplest and most direct nature interests and pleasures, to a thoughtful maturity grasping the deepest speculative problems of practical life, grappling with its most urgent and difficult tasks. Yet, old as we are, we shall still ramble and collect flowers together; indeed encourage this all the more because we have come to see that the child's herbarium is not in most cases an end in itself, but is a preparation for either library or counting-house, an introduction to Mill's *Logic* or to American book-keeping. Thirty years ago we exercised our microscopes upon the markings of a diatom; we mounted and labelled it without a thought of practical applications; now we use higher powers and clearer definitions than ever, but apply them primarily to the bacteria of health or of disease. Our pure science has only developed all the more in consequence of becoming applied; our studies of the drama of life, of the struggle for existence, are ever gaining in clearness and in intensity as we discern the same drama in our own lives, the same struggle, yet one capable of being raised into higher and higher forms; witness the varied output, bacteriological, industrial, social, of that most vital centre of modern medicine, the Pasteur Institute. In a word, the field naturalist of to-day will be the applied biologist of to-morrow: and conversely, let him who would apply biology to-morrow consider the simplest beauty of growth in the fields to-day.

From all these points of view, then, not only large hopes are justifiable, but large aims are necessary. We see that, while the work of a naturalists' society was formerly almost entirely scientific, it is now also no less educational, and this in the widest sense and at every stage, from child to citizen. The museum, which has to be the starting-point and the treasury of each subdivision of nature-students, is thus obviously justified; and it is evident that, while we may and must profit by all preceding experience, it is by no means certain that the museum of a generation, or even a decade ago, can be simply reproduced with the best advantage here and now, any more than could the machine or the weapon of the same period. Profiting, then, as fully as possible, by the Perth example and initiative, and as far as possible utilising its suggestions even in detail, we must still think out each point of our proposed regional and type museum anew for ourselves. How is this to be done?

We have obviously to take due note of the detailed advances in each department of natural science. To these we must adapt a fuller development of educational purpose. We must organise a fuller adjustment to the nature-study movement. We must set up the needful apparatus for the active study of the environment, and not merely prepare collections illustrative of it. We must add, too, such further collections, such illustrative material and experimental facilities as may be possible to illustrate the bearings of nature-studies upon industry and social life. Shall we not have thus clearly developed our plans?

Yes and no. Even after all that has been said, we have not yet clearly defined the main difference between the naturalists and museum-makers of the past generation and of the present one. The older naturalists were each concerned with their own special sciences or subsciences, each practically considered as an end in itself, and no doubt for a time this was a condition of progress, a specialism as necessary as the division of labour in industry. But here came in their limitation also. Even after Humboldt and Brown, Darwin and Wallace, had demonstrated the importance of geographical distribution, this distribution was looked upon as a final fact rather than an initial condition respecting any form of life. Regional lists were constantly made, floras compiled, faunistic collections accumulated; yet at first, and for a long time, rather by way of completing the inventory of the forms of life accessible within a given region, a country or a county, and this more often in its political or administrative limits rather than its natural one. Here was a mere beginning of the geographical point of view; and we may perhaps most simply sum up the difference we would emphasise by pointing out that the older naturalists, as indeed a good many existing ones, are rather at the standpoint of the older scientific societies—the Royal Societies, the Linnean, or the Edinburgh Botanical—than of the Geographical Societies.

The Perth Museum, however, largely owes its eminence to the very considerable measure in which the geographical, the *regional*, idea emerges, yet even here not so clearly as we would fain see.

Here in fact we reach the standpoint from which the museum of the present and of the immediate future must plainly be designed: the task

is no longer that of making Collections, however completely illustrative of the region or district. It is the illustration and interpretation of the Region as fully and completely as may be, in all its aspects and relations; and this requires of course the best attainable collections as its illustrative material. In a word, where the older museums contained a Collection, the newer museums begin, and that increasingly, to express and organise a Survey, to institute and maintain this. To utilise and to participate in such work, and to co-ordinate, display, and unify the results of every form of survey within our range—that, I take it, is our problem. The work of the Ordnance and Geological Survey is thus fundamental; while co-operation with the work of the Scottish Meteorological Society, with the British Rainfall Inquiry, is obviously indispensable. The Botanical Survey of Scotland, instituted by our much-regretted friend, the late Robert Smith, now happily continued by Dr. Smith and Mr. Hardy, is our next fundamental document and task, while to this we must add, as fully as may be, the floristic completeness of the late Dr. Buchanan White, or at present, in still more intensifying ways, of Professor Trail. Following upon this extending Botanical Survey comes the Zoological, so peculiarly well illustrated at Perth as regards terrestrial and fluviatile life, to which we must here add the maritime.

The inter-connection of these many branches of study has also gradually to be worked out, and here again we have the obvious advantage of eminent initiative and guidance, and these from a thoroughly geographical point of view. First, for instance, we may profit by the Lake Survey so admirably prosecuted by the late Mr. Pullar and now directed by Sir John Murray. One of the largest and most comprehensive indications and examples available to us is that of the Survey of the Forth [1] now begun under the auspices of the Scottish Natural History Society; while another and a more advanced example of such comprehensive research will be found in the valuable volumes monographing the Clyde Basin prepared by Glasgow naturalists for the British Association Meeting of 1901.

The elaboration of this comprehensive scheme of Regional Survey does not, however, end here. To be educationally adequate, economically and socially useful, it must include a human survey as well. For the fundamental Anthropological Survey no better example and pattern can be found than that initiated by Mr. Tocher in West Aberdeenshire, and thence spreading over the land. For Archæology we have within easy reach the example of the admirable museum of the Scottish Antiquarian Society, while in this city, so rich in monuments, in associations and in antiquarian lore, there is little fear of historical interests being forgotten. The continuing of these up to the actual statistical and social survey of our own time, the preservation of contemporary records of all sorts, and the corresponding Photographic Survey which similarly ranges into every department of study and field of observation—these are, above all others, the duties we most owe to our successors, and which we can best and most easily perform for them.

[1] Newbigin, "The Proposed Forth Survey."—*Scot. Geog. Mag.* 1901.

The details of such a regional survey and its elaboration in and by a museum-collection will involve the prolonged inquiry and consideration of the society, and are not likely to be settled speedily; while beyond these again arises the further question—that of how far, as in Perth, small type collections are necessary to illustrate nature and life outside our immediate region, our little world. Here once more our local studies, our small regional treasures and interests, lead us up to the largest problems of culture, to the interpretation of the world.

The planning and experimental realisation of such a combination of regional and general outlooks has long seemed to me the very problem of problems; for in this the work of a naturalists' society meets and combines with that of a geographical one, and this whether we look first to the scientific completeness of our survey of the world, or to educational and practical usefulness in it. Enough, however, at present merely to indicate this as an approaching problem: its urgency will appear in due time. A society like the present, with its membership including alike the child-naturalist and his teachers, the workman and his industrial chief, the ordinary citizen and his leader in church and in state, cannot fail to reach it; sooner indeed than can the scientific societies of more specialised task and membership. For by the very multiplicity of our interests, the comprehensiveness of our work, we must look at nature and life together.

PEKING UNDER THE ALLIES.

By Captain Richard Steel, 17th Bengal Lancers, late A.D.C. to General Sir A. Gaselee, G.C.I.E., K.C.B.

The year 1900 was so full of rapidly succeeding sensations, and, moreover, the attention of Englishmen was so centred in the struggle in South Africa, that what is without doubt the most stirring of modern events, has excited but a passing interest. A few illustrations in the *Graphic*, a series of able articles in the *Times*, a book or two hastily compiled to catch the public interest before it waned, serve to record the unveiling of the most sacred mysteries of the most exclusive and conservative empire of the world.

A tragic comedy. Such a motley crowd of players—Cossack and Sikh, Mandarin and Zouave. Scene—the Forbidden City.

Could any bill be more attractive? It is indeed difficult to do justice to the play as I saw it, to give even a small idea of the surpassing interest of its scenes.

Every one is more or less familiar with the dramatic story of the siege and the relief of the Legations; it is with the conditions of our life in the capital of China during its occupation by the West that I propose to deal in this paper.

Each day in August 1900 brought increasing order out of the chaos which followed the flight of the Chinese Court, troops—British, Ameri-

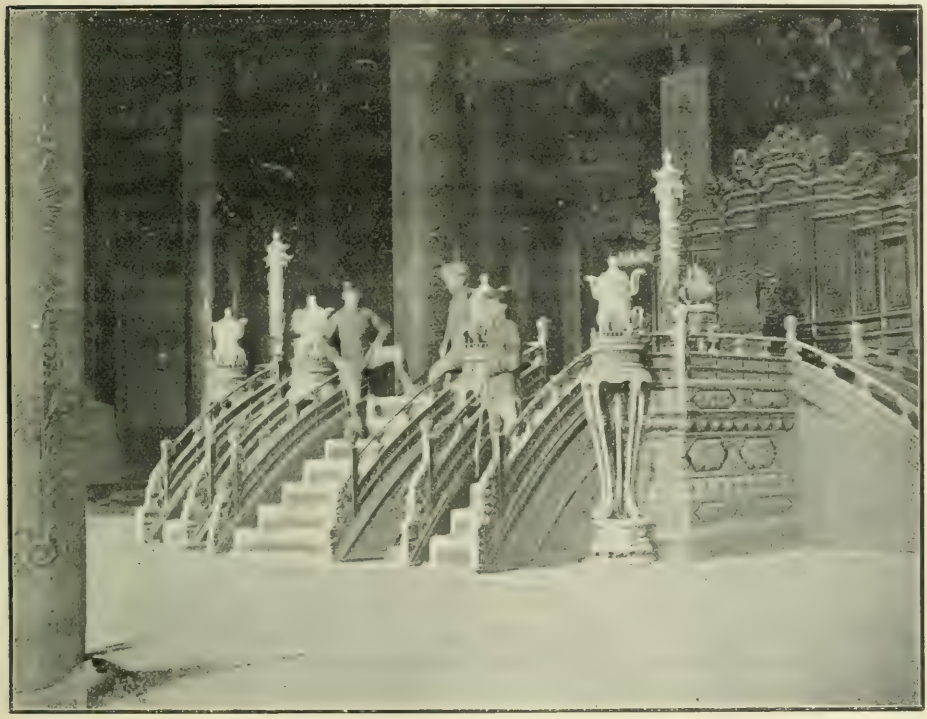
can, German, Russian, French, and Japanese—poured into Peking, and it soon became evident that an allied occupation of the city and its surroundings during the winter was imperative. With the advent of such a force, conditions of life in Peking became suddenly revolutionised. The city, according to agreement among the allied commanders, was divided into sections, each section ruled by its Power with that Power's own peculiar idiosyncrasies. Thus a walk in one quarter would recall the paternal care displayed for the citizen in Frankfort, while another, in its

Outside the Emperor's Quarters.

cheery disregard for sanitary questions, would call up as vividly the joys of a spring in Florence. Later on, a central committee, composed of representatives from each contingent, under the presidency of General von Gayl, the German second in command, and financed by Li Hung Chang, controlled the police, lighting, and sanitary arrangements of the city. Peking and its neighbourhood, under this administration, enjoyed such a measure of security to life and property as they had never before experienced. Soon it became possible to visit every corner of the vast capital, and, with the establishment of regular routine, officers and others found time to explore thoroughly the many places of interest which up

to that time had remained closed to the hated foreigner. The "Forbidden City" was naturally the chief attraction. Its pink walls had been kept inviolate, posts furnished by the Americans and Japanese guarding its four entrance gates.

On certain days in the week there assembled at the southern entrance a cosmopolitan crowd of officers of all nations, armed with "tickets to view," granted by their respective commanders. An American sergeant with a couple of privates, a pair of Chinese officials with that bored air which stamps the professional guide, accompanied the party.



The Outer Throne Room or Audience Hall.

A visit to the Forbidden City was like undoing an interesting parcel. First the brown paper—an outer court, next an inner wrapping—another and a finer court, a few folds of tissue paper and cotton wool—the outer halls of audience and pavilions. At last—the entrance to the "Son of Heaven's" quarters. What an air of desolate grandeur hung over all!

Weeds and even bushes forcing apart the carved marble balustrades of the terraces which rise tier after tier to support the various pavilions and halls. Dust an inch thick on the Peacock Throne, pigeons innumerable cooing under the carved, gilt cornices, flitting here and there in the sombre halls, perched on the wonderful gilt wood-carving which is

lavished everywhere. The Emperor's bedroom is a dark and gloomy chamber, his bed a queer recess covered with a blue satin coverlet. Quaint doors, in unexpected corners, carved screens, priceless gems of Chinese art, contrast strangely with shoddy importations from the West. Clocks everywhere, a piano, a complicated harmonium, even a gramophone lurk in dark corners. A clockwork toy jostles a solid gold elephant a foot high, sparkling with gems, the masterpiece of some Canton jeweller. Scrolls of exquisite design, many of which are reputed to be the work of the Emperor himself, hang, covered with wise saws of

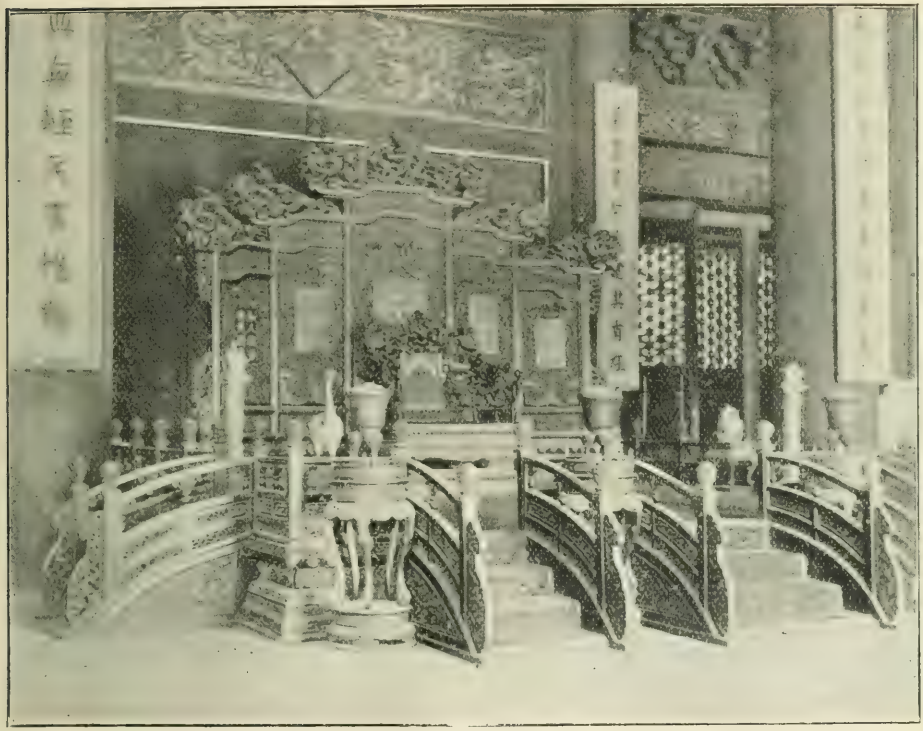
The Summer Palace.

old-time philosophers, on every wall. The Empress-Dowager's apartments adjoin those of the Emperor, and are lighter, airier, and open on to beautiful flagged courtyards. The women's quarters were sacred from the curious eye of the sightseer, and so, with a visit to a dark and gloomy temple shrouded in fir-trees, the tour of the palace ended at the north gate.

The Summer Palace, which lies some seven miles north of Peking, and is connected with the city by a road paved with huge blocks of granite, became quite a holiday resort for those wearied with the gayness of the metropolis.

The Russians were the first to occupy the palace, and are credited

with having removed the wonderful works of art with which it was filled. Certain it is that upon the arrival of their successors, the British and Italians, very little that was movable remained in the hundreds of rooms scattered on the borders of the lake. The severity of the winter was greatly mitigated by the splendid sunshine of each day. Though the thermometer would register a few degrees below zero in the shade, and the ice lay a foot thick over the lake, a stay at the Summer Palace in January was delightful. Officers of all nationalities rode out for the



The Emperor of China's Throne.

day to enjoy the hospitality of the British and Italian detachments, and join them in duck-shooting or skating on the perfect ice of the lake.

The Emperor's steam yacht lying frozen in, and stripped by the Chinese of all movable mechanism, formed an incongruous foreground to the picturesque summer-houses and high-arched marble bridges which border the water.

The marble barge, an absurd caricature of a penny steamboat, made a capital lunching-place, and the incongruity of it all was considerably heightened by the tinkling mandoline of some Italian soldiers barracked near.

During the long winter international courtesies were many, and disagreeable incidents few and unimportant, a striking indication that the old order is giving place to new as far as the relations of the Powers is concerned. A spice of excitement would be added now and again by the formation of small punitive expeditions, which, from time to time, became necessary to deal with bands of ex-Imperial soldiers and reputed Boxers which infested the neighbourhood.

The advent of Prince Ching and Li Hung Chang excited many rumours as to the possible return of the Court. Luckily, these astute

Li Hung Chang visiting Sir A. Gaselee and General Barrow.

statesmen failed in their endeavours to promote the same discord among the allied commanders that they succeeded in sowing in the diplomatic body.

With the reconstruction of the Peking-Tientsin railway line, and the opening of sea communication by the melting of the ice on the coast-line, a crowd of traffic poured into the capital. The troops were gradually withdrawn, and the city handed back to the Chinese authorities, and one of the most interesting occupations in the history of the world came to an end.

Amongst other photographs which I was fortunate enough to secure

is one which I expect will be of great interest to readers of this journal —a unique group for which the late Li Hung Chang, Sir Alfred Gaselee, and General Barrow, our Chief of the Staff, were good enough to give me an opportunity.

GEOGRAPHICAL NOTES.

AFRICA.

French Expedition to Central Africa.—At the beginning of February news was received of the death of the Vicomte du Bourg de Boyas, the leader of an expedition across Africa from east to west. The death of the explorer was apparently due to fever, and occurred in the Gold Coast Colony when he was on his way home. Previously nothing had been heard of the expedition since the middle of last September, when news came of its safe arrival at Nimule, a British post in the Uganda Protectorate. During the greater part of 1901, the expedition was conducting investigations in Southern Abyssinia. Thence the party journeyed to the north end of Lake Rudolf, and from this district by a new route to the Nile. The equipment of the expedition was exceedingly complete, and it is anticipated that the results will be proportionately rich ; a circumstance which makes the death of the leader all the more tragic, especially occurring at the moment it did.

AUSTRALASIA.

Tidal Wave in the Pacific.—On January 13 a terrible hurricane broke over the Society Islands and the Tecunotu group, and was accompanied by a tidal wave which entirely devastated the islands, and destroyed great numbers of people. The islands rise scarcely twenty feet above sea-level, and it is stated that the wall of water which swept their surface reached a height of forty feet. Those of the inhabitants who escaped with their lives did so by climbing to the tops of the highest trees, but many of these were overturned by the water. It is estimated that thousands of natives lost their lives.

Recent Dust-Storms in Australia.—Two correspondents in *Nature* for January 1st draw attention to recent dust-storms in New South Wales, Victoria, and Tasmania. In the two former places heavy dust fell, evidently brought from the west. Further, persons who had crossed Sydney Harbour reported that the wavelets between the steamer and the sun showed streaks of brilliant metallic blue colour. The water, where undisturbed, was covered by a slight scum, which might be either settled dust or a layer of mineral oil, but appeared more like the former. The colour had not the iridescent appearance caused by oil, as it was a uniform pale blue and only showed on the back of the wavelets.

The phenomenon was perhaps an exaggerated example of the blue colour of water caused by finely divided mineral matter seen in glacier waters and those of the hot lakes of New Zealand, where the water has silica in suspension.

At the same time in Tasmania heavy rain fell, charged with brown, earthy matter, which had evidently come, in the form of fine dust, from the interior of Australia, and had been whirled along in the upper regions of the atmosphere.

Fire-Walking in Fiji.—An interesting account is given in *Nature* of a fire-walking ceremony on the island of M'Benga, near Suva, by members of the Nga

Ngalita tribe. A circular pit was first made, about twenty feet in diameter and two feet in depth. Poles were placed radiating from the centre, dry palm fronds were placed on these, and firewood stacked above. Finally, large stones were heaped on the top till the whole was several feet in height. The fire was lit about forty-eight hours before the ceremony began, and was kept fed with wood till eventually the whole mass glowed with a white heat. As the hour for the exhibition approached, the natives, by means of long saplings, drew out all the logs not yet burnt away, till there seemed to be nothing left in the pit but stones. Next, by means of a hawser-like vine they turned the stones over and over and flattened them out. Meantime the saplings blazed vigorously on coming into contact with the hot stones. Now amid deep silence ten Fijians step on to the stones and walk round the pit, taking some ten or fifteen seconds to complete the circuit. They step off quickly, and great masses of green leaves are thrown on. The fire-walkers then rush back and press down the leaves, which give off great volumes of smoke.

A man examined before the fire-walking was found to have a pulse a little over 90, and the hands and feet a little cooler than the rest of the body. The feet were perfectly clean and odourless, and no preparation could be detected on them. The soles were yellowish-white, perfectly smooth and pliable, and like soft kid. The man wore a petticoat of dry hibiscus bark and canna leaves, with small anklets of dry bracken. A man examined afterwards had a pulse of about 120; the soles of the feet seemed cool, if not cold, but the temperature on the calf was like that of a man in high fever. None of his vegetable clothing was scorched, not even the dry bracken anklets, and the short hairs on the legs were not singed. Dr. Fulton (to whom the account is due) immediately after the ceremony stood for a second on one or two of the stones, and found that they did not brown his boots, though evidently they were too hot to handle. He asked a native to get him one, and the man, after moving the heated stones about with his bare feet, raked out a piece from the heap, but it was too hot to hold in the hand.

The explanation Dr. Fulton offers is as follows:—The arrangements for heating were peculiar: if what was required was merely a surface of red-hot stones to walk upon, it would be easier to lay flat stones in the pit and to maintain a huge fire on them. The stones took forty-eight hours to get to their "proper" condition, and were also found to cool very slowly. The same stones are never used twice. They are gradually heated until split by the expansion of the contained water, and are then carefully arranged, fractured side upwards. The stone that was examined was an augite-andesite of ordinary type. Now it has been found that, taking the thermal conductivity of copper as equal to 1000, that of andesite is 6·67, that is, it is a very feeble conductor of heat. In testing the radiation, iron being the standard at 100, andesite is 48. Thus the fractured, or inside, surface of the stone, owing to its slow conductivity, does not receive nearly the amount of heat one would expect, and, owing to the slow radiation of heat, the foot is not burnt when coming into contact with the stone for a second or less; as a matter of fact, the sole of the foot was at no time in contact with a hot stone for more than half a second. The foot is naturally cold or artificially cooled; it is a well-known fact that one can bear with cold feet for a long time (up to a minute in some instances) heat from a fire which would be insupportable at ordinary foot temperature.

In an article on Tahitian fire-walking in *Nature* of August 1901 a somewhat similar explanation was given. As the author of the present article points out, it is satisfactory to find that these investigations by scientific men agree, on the

whole, and that a rational explanation is forthcoming for this sensational performance. The walking on glowing embers, which is well known in parts of India, probably has another solution

POLAR.

New Arctic Expeditions.—It is announced that Dr. Jean Charcot will start in May on a scientific expedition to Iceland, Spitzbergen, and Novaya Zemlya. The expedition is to be under the patronage of the French Academy of Sciences. One of its chief objects is to be the study of the habits and the general biology of the cod-fish, but the expedition will spend some time in the neighbourhood of Spitzbergen in order to investigate the ocean currents of that region, and hopes also to do good work in the mapping of the islands of Novaya Zemlya. The staff is to include two zoologists, a geologist, and naval officers, specialists in astronomical and meteorological work. It is also probable that M. de Gerlache, the head of the Belgian Antarctic expedition, will assist Dr. Charcot. The vessel of the expedition is to be a yacht built in cast steel.

It is further announced that Commander Peary intends once again to brave the rigours of the Arctic, and make yet another effort to reach the Pole. Commander Peary is engaged in looking out for a suitable vessel for his new effort.

Mention has already been made here of the projected expedition to the Magnetic Pole, under the command of Captain Roald Amundsen. The expedition is to set forth on April 15 from Christiania in the *Gjoa*, a boat of only forty-eight tons, and is to consist of eight men in addition to the commander. The first winter is to be spent at Leopold Harbour in North Somerset, and the leader expects to remain away for four to five years. The object is to carry out a complete magnetic survey of the whole region in the vicinity of the magnetic pole, which it will be remembered has not been visited since its discovery by James Ross. The magnetic equipment of the expedition is singularly complete, and the fact that the observations are to be carried out over a period of years should give them very great value. Captain Amundsen further hopes to return by the North-West Passage.

Baron Toll's Polar Expedition.—Two members of this expedition, Lieutenant Matissen, commander of the yacht *Zaria*, and Lieutenant Kolchak, with nine men of the *Zaria's* crew, arrived in St. Petersburg at the end of January after an absence of two and a half years. The members of the expedition passed the second winter, 1901-2, in Nerpitchiei Bay, in the island of Kotelnyi, New Siberian group, where they lost one of their number, Dr. Walter. The party did not suffer from scurvy, and the great abundance of driftwood furnished them with material for the construction of dwellings and for fuel, while the reindeer supplied them with fresh meat. Baron Toll, who, accompanied by M. Zebert, the astronomer, left the *Zaria* to explore the interior of Bennett Island, and M. Bialznitsky, the zoologist, who had gone on an expedition to New Siberia, did not return to the ship before her departure, and were left behind. No fears are, however, entertained for their safety, and at the beginning of February a relief expedition was sent from the mainland to New Siberia to bring them away. Baron Toll's was the only expedition left in the Arctic regions during the present winter.

GENERAL.

International Geographical Congress at Washington, 1904.—The Eighth International Geographical Congress will assemble at Washington in 1904, probably

at the end of May. General Greeley, Chairman of the Committee on Arrangements for the Meeting, has inquired how many members of the Society are likely to attend. Members who propose to do so are invited to send in their names to Colonel Bailey, Secretary of the Society, who will communicate to them such information regarding the Congress as may from time to time be available.

Ordnance Maps in Geographical Education. — As briefly noticed in our last number (p. 105), Mr. A. W. Andrews read a paper on this subject at the meeting of the Geographical Association. Mr. Andrews emphasised the necessity for the use of maps showing the elevation of the land in any sound system of geographical teaching. He recommended the hill-shaded maps of the Ordnance Survey, combined with contour-lines, and pointed out that the relation of hills and valleys to one another and their influence on human life in wider areas than the home one can be studied from the diagram hand maps, which show in colour the relief of the main regions of the world. But in order to illustrate fully the influence of land elevation on human life, it is proposed to put together for the use of teachers a series of lantern slides and lantern maps, illustrating a number of typical areas in detail. Such a typical area is that afforded by the coast of Cornwall in the Land's End Peninsula. Here barren moors dotted over with granite tors and in the summer ablaze with gorse and heather, slope steeply down to the flat plateau, once the old sea-bed, on which the life of the district is concentrated. The eye sees a vista of small fields, like squares on a chessboard, bounded by loose walls of stones which have been cleared from the field. Below to the sea slope cliffs covered with gorse and heather ending in rugged cliffs. The character of the scenery varies greatly owing to the appearance of granite and greenstone through the Devonian beds, which form the bulk of the Peninsula. Pillars of a cyclopean masonry or dark chasms of greenstone, the remains of old sea-caves that have lost their roof, are close to Devonian Rocks which resemble the ruined battlements of a castle, and granite pinnacles with their straight, square cut sides complete the scene. Among other interesting points which can be shown by photographs are logan rocks, rock basins, old mines, pointing to the once flourishing industry of the area, or, older still, such memorials of a remote past as the Cromlech of Zennor Hill. As Mr. Andrews, points out by studying a series of typical districts illustrated in this way the student would gain a far clearer idea of the scenery and structure of the British Isles than from generalised text-books.

The Treaty between France and Siam of 7th October 1902.—For some time past very strained relations have existed between France and Siam, the treaty of 3rd October 1893 having left unsettled several questions such as the rectification of the frontier adjoining the Mekong river and the Great Lake (Talé Sap), the evacuation of Chantabun, etc. On 7th October last a treaty was signed determining with greater precision the relations between the French territory of Indo-China and Siam. By it France agrees to evacuate Chantabun and to give up the neutral zone of twenty-five kilometres (about fifteen and a half English miles) on the right bank of the Mekong, which in future will be occupied by the Siamese. She consents also to give up the provinces of Battambang, Angkor, and Siem-reap, although they belonged a quarter of a century ago (according to Francis Garnier) to the crown of Cambodia.

On the other hand, the French will gain by the new treaty a rectification of their frontier on the NE. of the Great Lake (Talé Sap).[1] In future this frontier will start from the mouth of the river Stung Roluos and proceed by a slight bend

[1] See Map, *S.G.M.*, vol. xii. (1896), p. 148.

NE. to the ridge of the Pnom Dong Rek, a plateau which rises above the low plains of Cambodia and contains the basin of the river Mun. In this way the old Cambodian provinces of Meluprey and Bassak, on the right bank of the Mekong, will be annexed to Indo-China [1] (Article 1 of the Treaty). A rectification of less importance is made in the territory of Luang Prabang on the right bank of the Mekong.

Articles 3 and 4 endeavour to define the vague term "zone of influence" employed in the Anglo-French treaty of 15th January 1896 with regard to the Siamese portion of the Mekong connected with the territory of the Se Mun. In this territory the Siamese are authorised to keep only troops which are wholly Siamese, thus preventing the introduction of either European or Japanese officers. With regard to the construction of harbours, canals, or railways in this territory, Siam must come to an understanding with France "in the event of these works not being able to be constructed and financed by Siamese alone."

Much the most interesting clause in the Agreement is that which relates to works of public utility. The railway between Bangkok and Korat proves that the Siamese are actively engaged in obtaining possession of the trade of Central Laos, which has always, in this respect, been subject to Bangkok. The French will endeavour to stop all foreign interference with the economic development of these districts, and trust that Siam will prove faithful to her engagements.—*Annales de Géographie* (Paris), 15th November 1902.

With reference to the last remark regarding Siamese probity, we may cite the opinion of the French "Comité de l'Asie Française," given in their "Observations" on this Franco-Siamese treaty :—"The new treaty places great reliance on the good faith of the Siamese, who are to accord to us privileges which are not specifically detailed. Past history has, however, shown us that the Siamese are the most crafty people in the whole Indo-Chinese peninsula. Certain appointments of high officials at Bangkok, which have been made *since the treaty was signed*, are, of themselves, quite enough to open the eyes of even the greatest believers in Siamese loyalty."—*Questions Diplomatiques et Coloniales* Paris), 15th November and 1st and 15th December 1902.

It seems strange that the French should make a treaty with the Siamese, and then, almost simultaneously, asperse their honour and good faith. We may add that the treaty is not yet ratified, that it need not be ratified till four months after its date of signature, and that the Comité de l'Asie Française advises that it should not be ratified in its present shape.

In its endeavour to allay the storm of opposition which the proposed Treaty has called forth from numerous French senators, deputies, and writers, the French Government has obtained important new concessions from the Siamese Government, and a Note was lodged in the French Chamber of Deputies on 6th December last by M. Delcassé, Minister of Foreign Affairs, stating that the Siamese Government now agrees—

(1) To institute immediately a Sanitary Department presided over by a French engineer with a French staff.

(2) To establish at Bangkok a Bacteriological Institute controlled entirely by French medical men.

(3) To employ without delay a certain number of professors and teachers of French in order to teach the French language in the colleges and schools of Siam.

(4) To reserve for Frenchmen a vast concession of teak forests in the valley of the Meing.

[1] Thus adding 25,000 square kilometres to French territory.

(5) Finally, to grant a subvention to the French Company of Navigation in order to insure a postal service twice monthly between Bangkok and Saigon.

The French Government therefore asks the Chamber to authorise the President of the Republic to ratify the treaty of 7th October last.—*Questions Diplomatiques et Coloniales* (Paris, 1st January 1903).

In the opinion of the journal just mentioned of 15th January 1903, the proposed Treaty is "bad, useless, and even dangerous, and its ratification by Parliament would be a serious error."

The members of the Royal Scottish Geographical Society will regret to learn that Mr. J. M. W. Gilchrist, who was for seventeen years with the Society as chief clerk, died at Queenstown, South Africa, on February 21st.

COMMERCIAL GEOGRAPHY.

The Siberian Fur Industry.—The Odessa correspondent of the *Standard* writes:—The chief centre of the Siberian fur trade, including that of the Peninsula of Kamschatka, is Irkutsk. The greater part of the fells here collected from hunters and trappers are bear, glutton, lynx, elk, reindeer, stag, musk-deer, fox, sable, marten, mink, ermine, polecat, squirrel, Alpine wolf, blue and silver fox, and one or two kinds of wild cat indigenous to Kamschatka. The Siberian black hare is not now so often found on the Irkutsk market. All kinds of furred skins have advanced in value during the last few years. A blue fox fur now brings about ninety roubles at Irkutsk, and that figure is enhanced when a pair of perfect skins are offered, the price running up to as much as three hundred roubles for the two fells. From Irkutsk the furs are, in the first instance, chiefly distributed between the two fairs at Kirensk and Vercholensk, and thence they find their way to the principal fur marts in Western Europe. Many of the English, French, and German furriers send buyers to Irkutsk. It has lately been shown, however, that one seldom buys at first hand even in that Siberian centre. The most valuable furs bought at Irkutsk from merchants who profess to retain their own hunters and trappers have, as a matter of fact, come through two or three pairs of bartering hands. It would not be a very difficult matter for the western buyers who travel all the way to Irkutsk to go a little further, and establish trading relations at first hand with the trappers and trapping syndicates. An enormous economy would be effected by such direct trading.

The Silk Industry of Lyons.—A memorandum from His Majesty's Consul at Lyons states that the French silk industry dealt in 1901 with about 16,874,880 lbs. of silk of all sorts. This is 3,031,600 lbs. in excess of 1900, but 2,309,120 lbs. less than in 1899. Of the 16,874,000 lbs. dealt with, France kept for her own use last year 10,075,340 lbs. The difference represents the amount sold or resold abroad. The number of silkworm rearers in France fell off in 1901; the number of eggs for hatching purposes remained the same, but the cocoon production was below that of 1900, though maintaining the average of the last nine years. Sericulture is not making any progress in France. It remains a purely domestic industry. Properly organised silkworm establishments are few in number, and there seems no tendency to increase them. The total crop amounted to 18,592,945 lbs., of which 990,000 lbs. were kept for eggs. The remaining 17½ million lbs. produced about 1,452,000 lbs. in 1901. French silkworms' eggs have, however, kept their good name on the foreign markets, and many of the French qualities have so good a reputation that they easily find a remunerative market. In 1901 the French silk-weaving

industry dealt with 18,094,780 lbs. of fresh cocoons as against 22,338,800 lbs. in 1899. France does not produce sufficient cocoons to supply her own wants, and is obliged to import as much as 3,268,760 lbs. The weaving in France was carried on under favourable conditions in 1901. Raw material was cheap, the price of silk went up about 7 per cent. during the busy times, and the prices of the finished article were good. But the industry suffered from the paucity of labour, and wages had an upward tendency. As regards the silk-throwing industry, waste silk-weaving has, for the past two years, been unsatisfactory, though work has not been wanting. The production of waste silk was considerable in 1901, and about 4¼ millions of lbs. were used in weaving. This is the highest recorded quantity ever used. There are in France a certain number of centres devoted to the silk trade. Their production for 1901 is estimated at £22,000,000; of this sum, Lyons contributed £17,580,000; St. Etienne, with its ribbons and velvets, £3,760,000; Picardy, £241,200; Nimes and Tours, with silk stuffs, silk thread, tulles, lace, and trimmings, contributed the remainder. As regards Lyons, the production in 1901 was slightly inferior to that of 1900 in value, but although the value in 1901 was about 10 per cent. less than in the preceding year, yet, as far as weight and yardage are concerned, the quantity was greater. The kinds of stuff that have shown a falling off were tissues of plain, pure silk, 5 per cent.; figured silk, 20 per cent.; plain unions, 9 per cent.; figured unions, 18 per cent.; representing a deficit of £942,000. This falling off is entirely confined to rich stuffs, plain silks, plain figured silks, or silks mixed with cotton or wool, fine union velvets, etc., owing to the fact that, for some years past, fashion has deserted rich silk stuffs. Lyons has, however, derived some benefit as a set-off to the decrease that has been noted in rich materials, in the very considerable production of light tissues for dress trimmings, fashionable novelties, etc.

NEW BOOKS.

EUROPE.

Across Iceland. By W. Bisiker, F.R.G.S. London: Edwin Arnold, 1902. *Price* 12*s.* 6*d.*

This is a very readable account of a journey "across Iceland" from Akureyri on the north-east to Reykgavik on the south-west. The expedition consisted of six members, one of them a lady, and as described by the author of this book was semi-scientific. Two of the party were botanists, one a geologist, one a sailor, one a jack-of-all-trades, and the sixth, *i.e.* the writer, was a geographer. They touched at the Faroe Islands, of which we have a pleasantly written description; then they proceeded to Northfjord, and thence coasted north and east to Husavik and Akureyri, where the real work of the expedition began. Notwithstanding the partial smash-up of his plane table at an early stage in the proceedings, Mr. Bisiker was able to survey a good part of the tract between, and in the vicinity of, the Lang Jökull and Hof's Jökull, but the work was considerably delayed and hindered by bad weather. The party then proceeded through the Geysir tracts, which have often been described, to Reykgavik. There the party broke up, but two of them, viz. the writer and the lady, remained behind and marched to the Surtshellir Caves, of which the writer made a thorough inspection. From there they went to Stykhisholm, *via* Statharhraun, where they again took ship and coasted along the north of the island, returning *via* the Faroes. It is difficult to believe that a party of five Englishmen going to Iceland did not have among them

a fishing-rod or a gun, but so it was with this semi-scientific expedition. They were in the land where there is abundance of salmon and trout, but only once do we read of one of the party fishing, and on this occasion it was the lady who handled the rod. At one place the writer tells us, "Gun I had not, nor ammunition; but I could have counted grouse by the thousand, ducks by hundreds, and golden plover by tens! I could almost have wept had there been time." The general verdict, we should think, notwithstanding the bicycle accident, will be, "Serve him right." The narrative of the expedition indicates that all the members thoroughly enjoyed themselves and had a very pleasant time. It is illustrated with many good photographs and a couple of useful maps, and the comic element is supplied, perhaps unconsciously, by the writer, who makes no attempt to conceal the uncomfortable relations between himself and his pony.

Outer Isles. By A. Goodrich-Freer. London: A. Constable and Co. 12*s.* 6*d. net.*

This book is not simply the outcome of a holiday visit. Miss Freer has spent summer after summer in these islands. She has made friends with, and obtained the confidence of, their inhabitants, and has, moreover, exhausted all available written authorities. These latter are mostly statistical accounts, Government reports, and books dealing with special subjects such as architecture, folklore, etc. The result is a work which, while it may be termed popular, contains a great deal of exact and authoritative information. It may be cordially recommended as worthy of perusal. These outer isles, Barra, North and South Uist, Harris, and Lewis have not yet come within the ordinary holiday-seeker's travels. Indeed, considering that they are part of the United Kingdom, it may be surprising how little is known of them even by the average member of a Geographical Society. In a series of chapters Miss Freer gives a description of the islands, their natural beauties and resources, their inhabitants, their traditions, their literature, and their religion. As might be expected from Miss Freer the chapter on the Ceildh is one of the most interesting. This gathering, which as she says is the substitute for the newspaper, the library, and the public-house, takes place at some house in the hamlet, and there in the long winter evening, round the peat fire, the faces of the listeners reflecting its glow, each takes his turn in narrating a story, which always introduces some element of the ghostly, the mysterious, or the supernatural. It is the Ceildh which has preserved the legends of the people, for, while many of these have now been committed to writing, many more exist only by being handed down orally from one generation to another. But the book is not wholly descriptive. Miss Freer holds strong opinions on questions which may be termed political, and while she never lectures, she expresses such opinions freely. Nor can any harm come from this. After all, what is forced upon one most strongly is the lamentably poor condition of the people. It would be going too far to describe them as unhappy. There seems to be something in their character which raises them above their circumstances and makes them contented in spite of all. Yet anything that tends to their social amelioration must be welcomed. Is it too much to expect that the report of the recent Commission on the Lewis, published since the issue of Miss Freer's book, may operate in this direction?

Guide to Annan and Neighbourhood. Historical, traditional, descriptive. By D. Watt. Fourth edition, revised and enlarged. Annan: D. Watt and Son.

The town of Annan was made a royal burgh by Robert the Bruce in 1300. Besides its historical interest it has many natural charms to recommend it to

visitors, and these are all amply set forth in Mr. Watt's little guide. Were it not for the delineation of the railway, one would imagine that the map might have been prepared about the time of Robert the Bruce, long before Timothy Pont brought about a reformation in Scottish cartography.

Murray's Handbook for Ireland. Sixth edition. Revised and edited by JOHN COOKE, M.A. With 43 Maps and Plans. London : Edward Stanford, 1902. Pp. 557. *Price* 9*s.*

We reviewed the re-modelled fifth edition of Murray's Ireland in 1900. The appearance of a sixth edition in 1902 is evidence of its well-deserved popularity. It has been thoroughly revised by Mr. Cooke, and is augmented by forty-one pages of new matter. The numerous maps by Bartholomew also appear to have been carefully revised to date.

Baddeley's Yorkshire. Part I. Fourth edition, revised. ("Thorough Guides Series.") 12 Maps and Plans by Bartholomew. London : Dulau and Co., 1902. Pp. 141. *Price* 2*s.* 6*d.*

This volume deals with the Yorkshire coast and the cities of York and Durham. It has been carefully revised to date, some new maps have been added, and there is every evidence of the thoroughness for which Mr. Baddeley's Guides have won such a high reputation.

ASIA.

Climbing on the Himalaya and other Mountain Ranges. By J. NORMAN COLLIE, F.R.S. Edinburgh : David Douglas, 1902.

A better name for this very interesting book would be "Recollections and Recommendations by an enthusiastic and successful Mountaineer," and it appeals, and appeals successfully, to a very wide circle of readers. The first chapters are devoted to a graphic account of the expedition in 1895, when Messrs. Mummery, Hastings, and Collie, and Major Bruce made a gallant but unsuccessful attempt to reach the summit of the mighty Nanga Parbat peak of the Himalayas, 26,629 feet above the level of the sea, an expedition saddened by the fact that in it Mr. Mummery lost his life. The story has been told before, but it loses nothing in being retold by Mr. Collie. We may quote his warm but well-justified eulogium on his trusty comrade and friend. "Although Mummery is no longer with us, though to those who knew him the loss is irreparable, though he never can lead and cheer us on up the 'gaunt bare slabs, the square, precipitous steps in the ridge, and the bulging ice of the gully,' yet his memory will remain—he will not be forgotten. The pitiless mountains have claimed him—and amongst the snow-laden glaciers of the mighty hills he rests. 'The curves of the wind-moulded cornice, the delicate undulations of the figured snow' cover him, whilst the 'grim precipices, the great brown rocks bending down into unmeasurable space,' and the snow-peaks he loved so well, keep watch, and guard over the spot where he lies."

Leaving the Himalayas Mr. Collie takes us across to the Canadian Rocky Mountains, regarding which he is as enthusiastic as Mr. Wilcox, whose work we reviewed in April 1901, and he confirms Mr. Wilcox regarding the great opportunities which the Canadian Rockies offer to those adventurous climbers who are tired of the Alps and what may be called the beaten tracks of mountaineering. From America Mr. Collie comes back to Europe, and describes in vivid and stirring language ascents he has made in the Alps, the hills of the Lofoten Islands, Skye, Kerry, and Cumberland, and to all Scotsmen his enthusiastic

eulogium of the Coolin Hills in Skye will appeal with triple force. The latter chapters of the book are reprints, but will be welcomed even by those who read them some years ago. Special commendation must be given to the illustrations of this work. They are undoubtedly the finest of their class which have come under our notice for a long time.

Delhi, Past and Present. By H. C. Fanshawe, C.S.I. London: John Murray, 1902. *Price* 15*s.*

We trust that the thousands of visitors who assembled in the historical capital of Upper India for the Coronation Durbar at the commencement of this year prepared themselves for a due appreciation of their surroundings by a perusal of this beautifully illustrated volume, which is much more than a guide to Delhi. The bulk of it is devoted to an account of the famous siege in 1857, carefully compiled from the many documents which are now available for such a purpose. Besides this we have a good description of the present city of Delhi, and how to see it and its environs, and an interesting historical account of ancient Delhi and its kings. There is also a brief notice of the different styles of architecture, which may be studied in the numerous remains of former buildings both inside and outside the modern city. Mr. Fanshawe knows his subject thoroughly, and has spared no pains or trouble to make his book interesting and exhaustive.

Einundzwanzig Jahre in Indien—Theil III.: *Sumatra.* By Dr. H. Breitenstein. Leipzig: Th. Grieben, 1902. Pp. 232. *Price* 6 *M.*

We have already noticed the first and second volumes of Dr. Breitenstein's experiences in the East Indies. The third volume, dealing with Sumatra, is even more interesting, as the country is perhaps less known to Europeans. In his official position as chief medical officer under the Dutch Government Dr. Breitenstein had exceptional opportunities for travel and observation during a period of about six years in Sumatra. His review of the country, its scenery, people, vegetation, animal life, products, climate, and diseases, is comprehensive and most interesting. There are a number of good illustrations, but the book is incomplete without a special map.

AFRICA.

À Madagascar. Dr. D'Anfreville de la Salle. With 17 engravings. Pp. 317. Paris: Librairie Plon, 1903.

The French have always found it easier to conquer a new possession than to derive any legitimate commercial profit from it afterwards. Madagascar is no exception to this rule. Before its conquest in 1895, the late Prince Henry of Orleans and other travellers had led some of their countrymen to believe that the island was rich in gold, and in this respect another Transvaal. As a matter of fact the veins are so thin that it does not pay to work them, and the gold found is alluvial, in the form of dust. It is washed out by the natives on their own account and sold to a French company that enjoys the monopoly of purchase. The island was also supposed to possess coal, and a company was formed to work the mines. As hardly any coal was found the director chartered a few hundred tons at Cardiff, intending first to bring it to Madagascar and then re-export it to France as Malagasy coal. But the coal-ship was lost, and the company consequently came to an end.

The quality of the soil varies very much. It is richest in the low ground near the coast, but this fertility is coupled with a very unhealthy climate for

Europeans. In the high central region, on the contrary, where it is salubrious and suitable for Europeans, the soil is poor and unfertile. In the south of the island india-rubber grows well, and the east coast is well suited for vanilla. In some places the mulberry thrives well, and attempts have been made to introduce the silk-worm, so that in time it is hoped a successful silk industry will develop.

One main reason why French enterprises are often unsuccessful is that the *employés* sent out from France are frequently ignorant, incompetent, and ill-paid. Anybody is good enough for the colonies. Two large and thriving German houses are far more liberal in their treatment of their *employés*, and consequently are very well served. But the future of Madagascar lies in the cultivation and improvement of the soil. Hitherto the right kind of colonist to do this has not arrived in great numbers. Many men of respectable family have come in hopes of making a fortune, and have returned to France after a few months quite disillusioned and all their money spent. The discharged soldier does not as a rule make a successful colonist. The little he knows of agriculture is of no avail in a subtropical climate. And in the retail trade there is no room for a European. It is already in the hands of natives of India, Greeks, and Creoles from the Mauritius and the island of Bourbon. Physically and morally the Creoles are an inferior people, and are appreciated neither in the army nor in the civil service. But those from the Mauritius, where they have been for a century under British rule, are better and more enterprising than the others. One of their great failings is a fondness for rum.

The finances of the colony are in a satisfactory condition, and show a small surplus, though that does not imply that the colony is self-supporting. The mother country has to pay thirty and a half millions of francs a year for the expenses incurred by military occupation. And the finances would be in a still better position were it not for the jobbery on a large scale by steamboat companies, and railway contractors and officials. On this subject the author has a good many queer stories to tell.

As the French have been but a very short time in possession of Madagascar, and the administration has already opened up the country by good roads, and has started several schemes for educating young men in the business and practice of agriculture, and for breeding horses and cattle, it is possible that the island may in the distant future become a source of wealth to the mother country.

L'Eritrea, dalle sue origini a tutto l'anno 1901. ("Manuali Hoepli.") Per B. Melli. Milano: Ulrico Hoepli. Pp. 163. *Prezzo L.* 2.

This is an historical sketch of the ambitious schemes of Italy in Ethiopia. The power of Menelik having asserted the independence of Abyssinia, the Italian colony of Eritrea is now limited to a small territory around Massaua on the coast of the Red Sea. There is a brief geographical description and a map of the colony.

GENERAL.

Cronologia delle Scoperte e delle Esplorazioni Geografiche dall' anno 1492 *a tutto il secolo* xix. ("Manuali Hoepli.") Per Luigi Hugues. Milano: Ulrico Hoepli. Pp. 487. *Prezzo L.* 4.50.

Of late years the Italians have made some valuable contributions to the history of geography and cartography, and we are glad to welcome yet another in the same department of research. This little manual by Professor Hugues is one of

the most complete chronologies of discovery and exploration, and should prove a most useful reference book. Dating from the time of that great Italian Cristoforo Colombo, whose genius was not recognised by his own countrymen, the progress of discovery is traced year by year down to 1901. The names of nearly 2500 explorers and geographers are dealt with.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Expédition Antarctique Belge, Résultats du Voyage du S. Y. Belgica en 1897-1898-1899, sous le commandement de A. de Gerlache de Gomery.

Astronomie, Étude des chronomètres, en deux parties, par G. Lecomte.

Météorologie, Phénomènes optiques de l'Atmosphère, par H. Arctowski.

„ Aurores Australes, par H. Arctowski.

Océnographie, Détermination de la densité de l'eau de mer, par M. J. Thoulet.

„ Rapport sur les Densités de l'eau de mer, par H. Arctowski et J. Thoulet.

Botanique, Mousses, et Hépatiques, par J. Cardot et F. Stephani.

Zoologie, Spongiares, par E. Topsend.

„ Échinides et Ophiures, par R. Koehler.

„ Brachiopodes, par L. Joubin.

„ Seals, by G. E. H. Barrett-Hamilton.

Imprimerie J. E. Buschmann, Anvers, 1902.

Mont Pelée and the Tragedy of Martinique. By Angelo Heilprin. Pp. xiii + 335. *Price* 15*s. net.* Demy 8vo. Philadelphia and London : J. B. Lippincott and Co., 1903.

In the Isles of the Sea. The Story of Fifty Years in Melanesia. By Francis Awdry. Pp. xiv + 150. *Price* 5*s.* 4to. London : Bemrose and Sons, Limited.

On the Coast of Cathay and Cipango Forty Years Ago. A Record of surveying service in the China, Yellow, and Japan Seas, and on the seaboard of Korea and Manchuria, by Wm. Blakeney, R.N. With illustrations by F. le Breton Bedwell, R.N. Also numerous sketches, maps, and plans. Pp. xx + 344. *Price* 12*s. net.* Demy 8vo. London : Elliot Stock and Co., 1902.

Practical Hints for Travellers in the Near East. Companion to the Guide-Books. By E. A. Reynolds-Ball, F.R.G.S. Pp. 150. *Price* 2*s.* 6*d.* Crown 8vo. London : E. Marlborough and Co., 1903.

Hindustani Grammar, Self-Taught. In four parts. By Captain C. A Thimm. Pp. v + 118. *Price* 2*s.* 6*d.* Crown 8vo. London : E. Marlborough and Co., 1902.

An Illustrated Guide to Caracas, containing General Data about Venezuela. Pp. 97. The Philadelphia Commercial Museum.

Jamaica, the New Riviera. A Pictorial Description of the Island and its Attractions. By Dr. James Johnston. Pp. 96. Size 9″ + 12″. London : Cassell and Co., Ltd.

Civilisation in Congoland. A Story of International Wrong-doing. By H. R. Fox Bourne. (With a map.) Pp. xvi + 311. *Price* 10*s.* 6*d. net.* 8vo. P. S. King and Son, 1903.

The Travels of Pedro Teixeira, with his "Kings of Harmuz," and extracts from his "Kings of Persia." Translated and Annotated by Wm. T. Sinclair. With further notes and Introduction by Donald Ferguson. Pp. cxviii + 292. London: Published by the Hakluyt Society, 1903.

Handbook for Travellers to Southern Italy and Sicily, with Excursions to the Lipari Islands, Malta, Sardinia, Tunis, and Corfu. By Karl Baedeker. With twenty-seven Maps and Plans. Fourteenth revised edition. Leipzig: Karl Baedeker, 1903.

Also the following Reports, etc.:—

Western Australian Year-Book for 1900-1. By Malcolm A. C. Fraser, F.R.G.S. In two volumes. Volume I. Government Statistician, Perth, W.A., 1902.

Hazell's Annual for 1903. A Cyclopædic Record of Men and Topics of the Day (revised to December 31, 1902). Pp. 750. *Price* 3*s.* 6*d. net.* Crown 8vo. London: Hazel, Viney, and Watson, 1903.

Report on the Administration of Burma for the Year 1901-2. Rangoon, 1902.

The Records of the Woolwich District. By W. T. Vincent. In Eighteen Parts. Pp. xlix + 824. *Price* 18*s.* Woolwich: J. P. Jackson.

British South Africa Company. Report upon the Present Conditions of Rhodesia, presented to the directors by J. F. Jones, Esq., C.M.G. Pp. 44. With Map of Rhodesia. London, 1903.

Sudan Almanac for 1903. Compiled in the Intelligence Department, Cairo. Astronomical calculations made in the Egyptian Survey Department, Cairo. London: Eyre and Spottiswoode.

Sinopsis Estadística I Jeográfica de la República de Chile en 1901. Pp. 521. Santiago: Oficina Central de Estadística, 1902.

Recent Discoveries in Relation to Pre-historic Man in Ealing. By Jno. Allen Brown, F.G.S. Ealing Natural Science Society, 1902.

Publishers forwarding books for review will greatly oblige by marking the price *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st December 1902:—Parish Maps (1:2500 Scale, Revised, with Houses ruled, and with areas. Price 3s. each). *Forfarshire.*—Sheets XXVII. 1, 5, 10, 11; XXXIII. 16; XXXIV. 9, 13; XXXIX. 4; LII. 5, 6, 9; LIII. 4; LIV. 4, 7.

Erratum.—In Addenda for November, Sheet LV. 8 should read LV. 3.

Island of Skye (*Inverness-shire*).—Sheet XLVI. 9; *Orkney.*—Sheets CVII. 15; CVIII. 3; CIX. 5; CXV. 14; CXIX. 9, 11, 12, 13, 14, 15; CXX. 4, 7 (10 and 9), 11, 13, 16; CXXI. 5; CXXII. 4, 8, 12; CXXIV. 3, 4.

Note.—There is no coloured edition of these sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Zetland.*—Sheets 43, 54; (Price 2s. 6d. each). Sheet (28 and 23) (Price 2s.).

Quarter-Sheets, *Forfarshire.*—24 SE. (Price 1s.). With Contours:—*Aberdeenshire.*—3 SE.; 8 SE.; 11 NW.; 12 NW.; 16 NE.; 51 SE.; 61 NW.; 81 NE. (Price 1s. each) *Forfarshire.*—31 SE. (Price 1s.). *Perthshire.*—75 NE. (Price 1s.).

General Remarks:—*Falkirk* (1 : 500 Scale).—Sheet XXIV. 15, 24. Coloured price now altered to 4s.

Six-inch County Maps. Unrevised engraved maps have been withdrawn from sale.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st January 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas, Price 3s. each). *Forfarshire.*—Sheets XXVII. 2, 4, 6, 7, 8, 13, 14, 15; XXXIV. 1, 2, 3, 6, 7, 10, 14, 15, 16; XXXIX. 8; XL. 1, 2, 3, 4, 7; LI. 8; LIV. 3, 13; LV. 1, 5. *Island of Skye* (*Inverness-shire*).—Sheets XL. 15, 16; XLI. 12; XLVI. 3, 5; XLVII. 1; L. 4. *Orkney.*—Sheets CXIX. 16; CXX. 12, 15; CXXIII. 1, 2, 6, 7; CXXIV. 2, 6, 7, 8, 10, 11, 14, 15.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Zetland.*—Sheets 14, 20, 22; 24 (Price 2s. 6d. each). Sheets 31 (44 and 45), 55, 61 (Price 2s. each).

Quarter Sheets. *Forfarshire.*—3 SE.; 24 NE. (Price 1s. each). With Contours:—*Aberdeenshire.*—2 SW., 2 SE.; 6 NW.; 12 NE. (Price 1s. each). *Forfarshire.*—25 NW., 25 NE., 25 SW.; 31 NE., 31 SW.; 32 SW. (Price 1s. each). *Perthshire.*—75 NW. (Price 1s.).

ENGLAND AND WALES. Bartholomew's New Reduced Survey. Scale 2 miles to an inch. Sheet 16 Aberystwith, Sheet 21 Pembroke, Sheet 22 Carmarthen. With orographical colouring and roads revised by the Cyclists' Touring Club. *Price* 1*s. Mounted on cloth*, 2*s.*

John Bartholomew and Co., Edinburgh.

These sheets complete the issue of Mr. Bartholomew's half-inch map of England and Wales.

ASIA.

INDIA.—Scale 1 : 4,055,040, or 64 miles to an inch. Published under the direction of Lieutenant-General J. T. Walker, C.B., R.E., F.R.S., Surveyor-General of India. Railways revised to 1902. *Price coloured, Six Rupees.*

Surveyor-General's Office, Calcutta.

In this map the railways are revised to 1902, but we fail to see why a Government publication of this importance, issued from the office of the Surveyor-General of India, should not be thoroughly revised to date. It would not be excusable for a private map publisher to issue a map of India without incorporating the work of the latest frontier surveyors and explorers. It is unfortunate that the best general map issued by the Survey of India cannot stand comparison with the map in Stieler's atlas.

INDIA.—M'Dougall's Photo-Relief Maps. *Price* 3*s.* 6*d. net, mounted on cardboard.*

M'Dougall's Educational Co., Ltd., London.

This map is effective, but, as its execution is incorrect, it is misleading. The Vindhya Hills appear as a high mountain range, whilst the elevation of Adam's Peak in Ceylon is scarcely visible. A map prepared without scientific method is not an aid to teaching geography, however effective it may be.

AFRICA.

CONGO. A Map of the Congo River between Leopoldville and Stanley Falls, from running surveys in the steamers *Peace* and *Goodwill* by the Rev. George Grenfell, B.M.S., 1884-89. In 10 section maps. Scale 1 : 250,000. With descriptive text.

Published by the Royal Geographical Society, London.

EGYPTIAN SUDAN. War Office Map of Africa. Scale 1 : 250,000, or about 4 miles to an inch. 1902. *District Sheets*—Suakin, Sinkat, Talgwarab, Adarama, Khartoum. Lithographed for the Intelligence Division of the War Office by Edward Stanford, London, from a Map supplied by the Director of Sudan Surveys. *Price* 1*s.* 6*d. each.*

Intelligence Division, War Office.

SOMALILAND. Map of a portion of ——. Scale 1 : 1,000,000. December 1902. *Price* 3*s.* *Intelligence Division, War Office.*

TOGOLAND. Karte von Togo in 10 Blatt im Massstabe von 1 : 200,000. Konstruiert und gezeichnet unter Leitung von Paul Sprigade. Im Auftrage und mit Unterstützung der Kolonial-Abteilung des Auswärtigen Amts herausgegeben durch die Verlagshandlung. Blatt E 2, Lome. *Price M* 2.

Dietrich Reimer, Berlin.

This is the first sheet of an important new map of Togoland. It is the most complete and authoritative map of the colony yet issued, and does much credit to the cartographer.

SOUTH AFRICA. Railway Map of ——. 1903. Scale 60 miles to an inch. With Statistics of Railways and Advertisements. *Price* 1*s.*; *on cloth*, 2*s.* 6*d.*

Published at the Offices of 'South Africa,' London.

AMERICA.

NOVA SCOTIA. Political and Industrial Map. Scale about 8 miles to an inch. Published by order of the Government of Nova Scotia. *Presented by the High Commissioner for Canada.*

A. and W. Mackinlay, Halifax.

UNITED STATES. Rand, M'Nally and Co.'s Indexed County and Township Pocket Maps. Mississippi, Missouri, Montana. 1902. *Price* 25 *cents each.*

Rand, M'Nally and Co., Chicago and New York.

BOLIVIA. Mapa de la Frontera con el Paraguay. Formado par Eduardo Idiagez, Ing. de Limites. 1902.

Oficina Nacional de Immigracion, La Paz, Bolivia.

NEW ATLASES.

THE SURVEY ATLAS OF ENGLAND AND WALES. A series of 84 Maps and Plans, with descriptive text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial features of the country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S., and published under the patronage of the Royal Geographical Society. In 21 monthly parts. *Price* 2*s.* 6*d. each. Part I.*, containing text, Plate 17—Carlisle and Keswick, Plate 18—Barrow and Windermere, Plate 26—Anglesey and Conway, Plate 80—County of London, showing Boroughs. 1903.

John Bartholomew and Co., Edinburgh.

GROSSER DEUTSCHER KOLONIAL ATLAS, Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von der Kolonial-Abtheilung des Auswärtigen-Amts—Lieferung 2. Die Deutschen Besitzungen im Stillen Ocean und Kiautschau. Nr. 26, Deutsch-Neu-Guinea (westliches Blatt). Nr. 27, Deutsch-Neu-Guinea (östliches Blatt) 1 : 2,000,000. Nr. 28, Marianen und Marshall Inseln, 1 : 3,000,000. 1902.

Dietrich Reimer, Berlin.

The same elaborate detail, combined with beautiful clearness of execution, characterises the maps in the second part of this fine atlas.

STIELER'S HAND ATLAS, Neue neunte Lieferungs Ausgabe von. 100 Karten in Kupferstich. Lieferungen 11, 12, 13, 14. Nr. 13, Thüring. Staaten. Nr. 42, Süd-Scandinavien. Nr. 65, Japan, Korea, and Ost. China. Nr. 79, Australien, Bl. 3. Nr. 87, Vereinigte Staaten, Bl. 2. Nr. 88, Vereinigte Staaten, Bl. 3. Nr. 90, Vereinigte Staaten, Bl. 5. *Price* 60 *Pfennig each Part.*

Justus Perthes, Gotha.

Among the new maps in these parts, Süd-Scandinavien by C. Scherrer is a beautiful piece of draughtsmanship. Dr. Haack's very clear and effective new map of Australia is now completed.

NEW STUDENTS' ATLAS OF ENGLISH HISTORY by Dr. Emil Reich. 55 Maps with text. 1903. *Price* 10*s. net.*

Macmillan and Co., Ltd., London.

This new work may be best described as a geographical and chronological summary of English History, and is designed to form a complement to any historical text-book. The diagrammatic maps to a great extent speak for themselves, but they are intended to be read with the chronological text. The plan is an excellent one and ably worked out. It leaves a graphic picture of the sequence of events in the student's mind. We only regret that the physical features are not shown on the maps; the conditions of a campaign or the frontiers of a country cannot be understood on a map without hills.

THE ROMAN EMPIRE. Murray's Handy Classical Maps, edited by G. B. Grundy, M.A. Section I.—B.C. 218-A.D. 100. Section II.—A.D. 1-300. 1903. *Price* 1*s. net.*

John Murray, London.

WALL ILLUSTRATIONS for Anthropological, Ethnographical, and Geographical Instruction, by Dr. Reed Martin. Types of the Human Race. Plate 1—Veddah. *Price* 28*s. per set of* 8 *Plates.*

Art. Institut Orell Füssli, Zurich.

TRACK OF THE "SCOTIA"

FROM SCOTLAND TO FALKLAND ISLANDS

BY CAPT. ROBERTSON

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE "SCOTIA'S" VOYAGE TO THE FALKLAND ISLANDS.

By the Leader and Staff of the Scottish National Antarctic Expedition.

(*With Map and Illustrations.*)

1. Narrative by Wm. S. Bruce.

The voyage of the *Scotia* from the Clyde to the Falkland Islands has been accomplished in an even shorter time than was anticipated. In 1892 the Scottish whaling fleet took no less than ninety days to reach Port Stanley from Dundee. It was suggested that sixty days might be the minimum run of the *Scotia*, though considerable doubt was expressed in some quarters as to whether she would be able to do the voyage so quickly. The actual departure from the United Kingdom may be regarded as from Kingstown on the 8th November, and the 6th January found the *Scotia* anchored in Stanley Harbour, having thus accomplished the voyage in fifty-nine days. This includes stoppages made at Wicklow Bay (through stress of weather), Madeira, St. Vincent, and St. Paul's—altogether six days,—besides the stoppages to test gear on several other occasions. An account of the voyage has already been given up to Madeira; it is therefore unnecessary to repeat this, especially as nothing very striking happened beyond the testing of the qualities of the ship. It may be pointed out that the relatively quick passage was made in spite of a considerable number of head and light winds, which caused the ship to steam nearly the whole way. This steaming was done at the most economical speed, in order to save as much coal as possible for the distance run; if money had been no object, by a greater freedom in the use of coal the passage would probably have been done in forty-five to fifty days. This long-continued trial of the new engines, during which period they have worked perfectly, gives us the greatest confidence in them for Antarctic work.

The departure from Madeira marks the commencement of scientific work, although previous to that time some general observations were recorded. Since that date a continuous series of surface tow-nettings has been taken as well as four-hourly meteorological observations, and regular observations of sea temperature, density, and colour. I considered it advisable, since we had to steam from Madeira to Cape Verde Islands, to coal at St. Vincent, where coal was much cheaper than at the Falkland Islands. Only ten hours were spent coaling, and we then proceeded again on our southerly course. Although St. Paul's Rocks were slightly out of our course, yet so great a desire is felt by naturalists to land on these isolated rocks that we steered for them and sighted them shortly

St. Paul's Rocks.

after 6 A.M. on the 10th December 1902. After breakfast a boat was lowered in charge of the second mate, accompanied by Messrs. Brown, Pirie, and Wilton, as well as by the two junior members of the scientific staff, Messrs. Cuthbertson and Ross, in order to attempt a landing. From the ship it could be seen that a surf caused by a heavy swell was breaking over the rocks. I therefore gave instruction that no landing was to be attempted should Mr. Davidson consider it dangerous, and this more particularly since there was a great number of sharks in the water. After trying for some considerable time to effect a landing, Dr. Pirie, in attempting to jump, slipped and fell into the sea. On seeing this from the bridge, I got Captain Robertson to recall the boat immediately, as I did not intend even to risk injury to the boat. Some fishing, however,

was done in the vicinity of the rocks and some birds shot, the boat being away for several hours, and considerable collections were made from material floating in the vicinity of the rocks. We were all naturally disappointed at not effecting a landing, but the accompanying photograph of the rocks showing the heavy surf beating over them will plainly demonstrate that it was utterly impracticable. In the bay that faces the NW. Sir James Ross actually took soundings with a small boat, and the *Challenger* Expedition was also able to effect a landing with a small boat; but this time the bay was a seething caldron in which no boat could have lived.

While the rest of the staff were making collections from the boat, Captain Robertson, Mr. Mossman, and I were testing some of the other gear on board. The Monaco surface trawl was put out and worked perfectly, and the small quick-working winch meant for hauling up the Nansen-Pettersen bottle and vertical nets, as well as for driving the Lucas sounding machine and the kite machine, was tested. Unfortunately, on account of too much loose wire being out, some kinks were formed which spoilt a considerable number of fathoms, but the machine itself worked perfectly. A flight was also made with the kite, which was raised from the boat by Mr. Wilton.

On the 13th of December we passed Rocas light bearing WSW. 30 miles, and at 4.30 P.M. on the following afternoon sighted the Brazilian coast on our starboard bow. Owing to considerable changes in the colour of the water, Mr. Wilton secured a number of samples for testing the density. On the 21st of December we dredged for the first time on the Abrolhos Bank in comparatively shallow water and secured a rich collection of animals. Up to this time we very frequently saw numbers of flying fish, as well as Portuguese men-of-war, and the more delicate Velellas. The interesting pelagic insect Halobates was secured on several occasions, both here and further south. On December the 18th in 13° 49′ S. 36° 50′ W., we had a very marked display of the phenomenon known as the green ray. This was the only occasion during the whole passage when it was well marked, though on a second occasion there was a slight display. An absolutely clear horizon is needed to view this beautiful phenomenon. The least cloud or haze, though the sun shines through it, is sufficient to destroy the effect. A sounding was taken in 39° 12′ S. 53° 44′ W. and no bottom was obtained in 2000 fathoms, and a second sounding on the 4th January in 47° 53′ S. 57° 27′ W. gave no bottom with 1200 fathoms. The sounding wire brought up on this occasion a Nemertean worm fully 10-15 fathoms long.

On December the 28th at 3 P.M., in lat. 34° 02′ S. long. 49° 7′ W., we passed through a sea which was irregularly crossed with orange-coloured bands ten to twenty feet in breadth and of great length. On lowering a boat to collect this and other specimens, we found that the phenomenon was caused by a great host of Diatoms.

We have been very hospitably received at Port Stanley by Governor Grey Wilson, who is showing the greatest interest in the Expedition, by the Colonial Secretary, Mr. Hart Bennett, as well as by many others.

Through their kindness a large quantity of surplus stores belonging to the *Scotia* have been stored in the Custom House store. Commodore Finnis of H.M.S. *Cambrian* also visited the *Scotia* and entertained us on board the *Cambrian*, besides filling our tanks with six weeks' supply of very fine condensed water, it being difficult to find water enough in Port Stanley of a good quality.

Mr. R. C. Mossman conducted magnetic observations on the same spot as the *Challenger* Expedition at Stanley Harbour on Navy Point, with satisfactory results. Sights were taken with the Barr and Stroud range finder which fell in very satisfactorily with known points. Besides

The *Scotia* in Port Stanley Harbour, Falkland Islands.

this there was also abundant opportunity of taking good sextant observations, and of testing the accuracy of the chronometers on board. Every assistance was given in this direction by the Navigation officers of H.M.SS. *Cambrian* and *Basilisk*.

To-morrow, the 25th January, we leave Port Stanley and steer a SE. course to the Weddell Sea until we reach a longitude of 30° W., or are diverted by ice being more open in some other longitude. Our general course will then probably be S. into the unknown. Should we be successful in finding a comfortable harbour, the *Scotia* will winter there and will return to the Falklands as soon as she is released in the spring of 1903-1904. It is still my opinion that a ship should preferably be a free-moving agent, but under the circumstances of the extreme

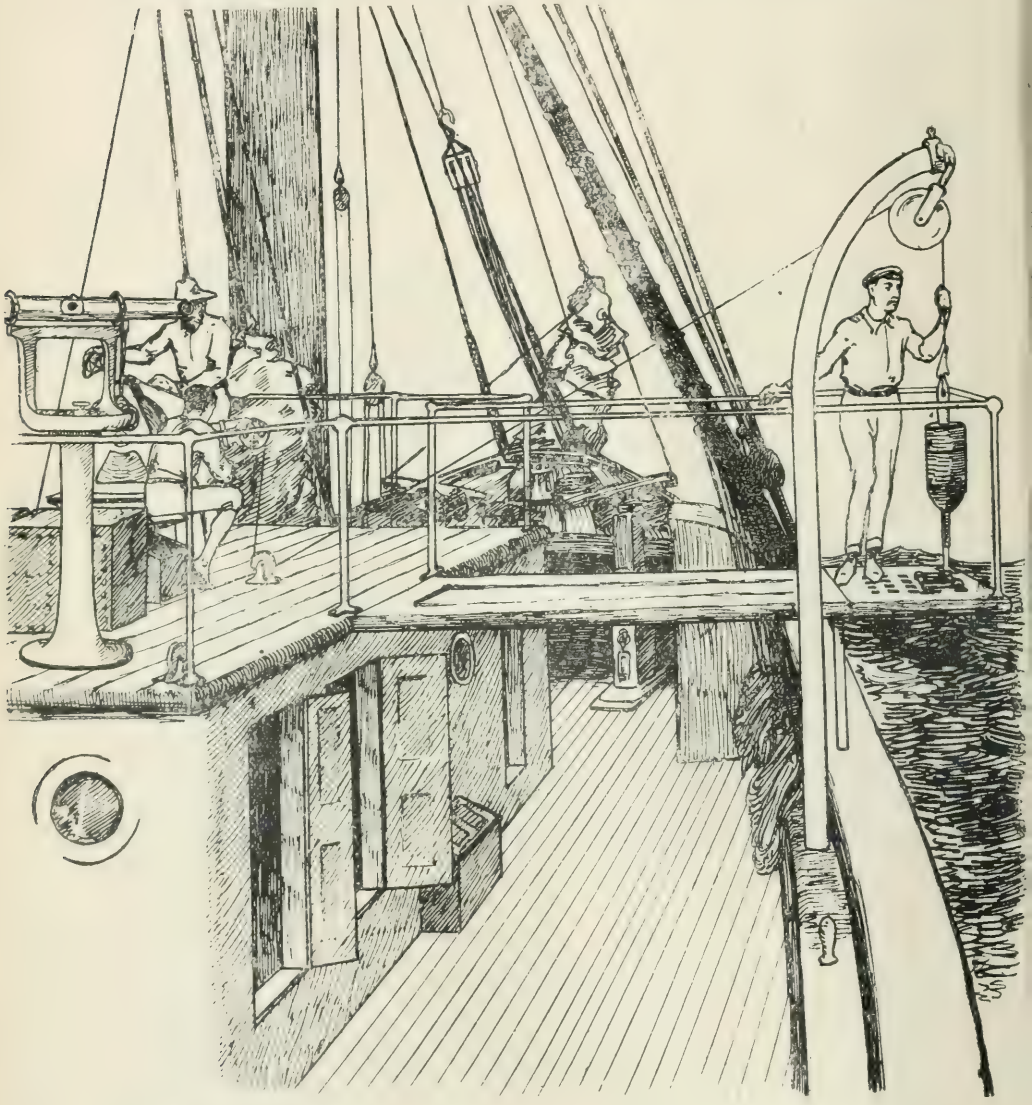
lateness of the season, and of the too great strain upon the funds of the Expedition to set up a winter station separately and let the ship explore further N. during the winter months, I have been compelled to adopt this change of programme.

In the summer of 1903-1904 the *Scotia* will return to Port Stanley to receive despatches, in the hope that those at home have been able to arouse enthusiasm sufficient to have added to the funds a sum which will be enough to keep the Expedition going for another year. This would certainly not only enhance the value of the observations taken by the Scottish Expedition, but also the results of all the other Expeditions with which it is co-operating.

2. Physical Observations of the Sea, by Wm. S. Bruce and D. W. Wilton.

Altogether observations on the density, temperature, and colour of the sea have been taken at sixty-seven stations between 30° N. and 52° S. latitude. These observations have been taken by Mr. Wilton, who has been assisted by Mr. Ross and Mr. Cuthbertson—the latter recording the colour of the water in oils. The temperature shows a natural increase as an approach is made towards the Equator, and the highest temperature recorded was 81·6° F. on the 6th December in 6° 39′ N. 25° 41′ W. A high temperature was maintained up to 25° S., during which time only on two occasions did it fall below the temperature of 79° F. After crossing the 25th degree of S. latitude, the temperature began to descend until it reached 75° F., on the 28th of December in 33° 50′ S. 48° 44′ W. After this date a very remarkable fall of temperature is recorded—there being a fall of 20° in five days, for the temperature was only 55° F. on the 2nd January in about 42′ S. and 54° 45′ W. A remarkable feature of this part of the ocean is not only the rapid fall of temperature, but also its extraordinary variability. Thus on January 2 the temperature at 4 A.M. was 54·1° F., at 8 A.M. 63·0° F., at noon in latitude 41° 38′ S. and longitude 54° 40′ W. it was 64·3° F., whereas it fell to 55·0° F. three hours later. Similar rises and falls in temperature occurred during the whole of the 1st and 2nd January. These are brought out graphically on a table and a curve constructed by Mr. Mossman. It may here be mentioned that even in the space of a few minutes a fall of 3° F. may be experienced in a distance of less than two miles. Thus on the 2nd January at 8 P.M. the temperature of the water was 56·9° F., at 8.5 P.M. it had fallen to 55·9°, and at 8.18 P.M. a further fall to 53·9° was observed. Mr. Mossman has also drawn out curves for the density of the sea reduced to 60° F. and also the actual density *in situ* according to the observations of Mr. Wilton. Both these curves show a depression in density between 25° N. and 15° S. There is one remarkable depression in about 6° N. on the 7th December, which appears to be distinctly associated with rainfall. The water again becomes less saline after passing the 28th degree of S. latitude, after which a remarkable variation in the density occurs in both curves, which seems to be distinctly associated with the

variation in temperature already referred to. It is difficult in a hurried summary of this nature to draw final conclusions, but it appears to us,



Scientific Deck-house on *Scotia*, showing Barr and Stroud Range-finder, Lucas Sounding Machine, and Buchanan Sounding Tube and Bottle.

especially in view of the two soundings of considerable depth that we have taken in this neighbourhood, as well as the deep soundings taken by the Swedish ship *Antarctic* during the winter months between S. Georgia

and the Falkland Islands, that these changes may be associated with an upwelling of cold Antarctic waters which are underneath the warmer waters of the more northern portion of the South Atlantic. This effect culminates in the extraordinary low bottom temperatures that are to be found off the coast of Brazil.

It is already well known that these changes in the temperature of the sea in the region mentioned are associated with marked changes in the weather, the weather in our opinion being largely affected by those changes.

Port Stanley Harbour from Navy Point, Mount William in background, quartzite rock jutting through peat in foreground.

3. Plankton and Botany, by R. N. Rudmose Brown, B.Sc.

(*a*) *Plankton.*—Systematic plankton work was begun in 26° N. and continued daily until Port Stanley harbour was reached. On the average three tow-nettings were taken daily. The net chiefly used is of No. 20 Swiss silk, and is 4 ft. long, with a mouth diameter of 4 in.; a small removable end 6 in. long of the same material is screwed on by means of a brass connection. This allows the catch to be quickly removed and carried into the laboratory for examination. A similar net of 6 in. diameter in the mouth is also used. These nets, especially the former,

have proved very satisfactory, and can be used at speeds up to seven or eight knots without showing any liability to tear. Larger nets of No. 3 silk and coarse muslin are also used. No opportunities have as yet occurred for the use of vertical nets or for quantitative work.

A most noticeable point in connection with this series of tow-nettings is their poorness in Diatoms. These were found very sparingly and far between (chiefly *Chaetoceras* and *Ethmodiscus*) until about 25° S. when they became rather more numerous. In 33° 51′ S. 48° 48′ W. immense masses of Diatoms (*Frugilluria*?) were met with in bands of 20-30 feet wide, colouring the sea bright orange (cf. p. 171 above). *Trichodesmium* was very plentiful in tropical and sub-tropical seas, but speaking generally the plankton was scarce within the tropics, and it was only in sub-tropical and temperate seas that the pelagic life became anything like abundant. Several species of Halobates were obtained from 24° 21′ N. to 24° 26′ S.; in the belt of equatorial calms (about 5° N.) they were very abundant. Practically no catch has been without Peridinians, and especially among the scarcity of planktonic life within the tropics their presence was very marked; *Ceratium* and *Histioneis* were the most abundant genera. Off the Brazilian coast *Pyrocystis noctiluca* was extraordinarily abundant.

(*b*) *Botany.*—Few opportunities have as yet occurred for the collection of land plants: at Madeira a small collection of phanerogams and mosses was obtained, and as extensive collections have been made as possible in the time available at the Falkland Islands.

Marine algae have been collected from Madeira, St. Vincent, and the Falkland Islands, as well as from St. Paul's Rocks, where five species of seaweeds were obtained, of which two are species of *Caulerpa*. A dredging off the northern coast of Brazil also yielded several species. Occasional specimens of seaweed have been caught in the tow-net. In 1° 42′ N. and 27° 29′ W. a large amount of organic débris was obtained in the tow-net, in which fragments of Fucus were discernible, as well as what seemed undoubtedly to be fragments of land plants.

4. Zoology,[1] by W. S. Bruce and D. W. Wilton.

As in other departments of science, so also in zoology, little opportunity has as yet occurred to do much systematic work. A beginning has however been made. All those animals which have been seen during the voyage have been noted, and as many as possible secured. Madeira offered the first real opportunity, when lizards, fishes, molluscs, and echinoderms were obtained. Since that time the tow-net has furnished daily opportunity for us to become more familiar with animal plankton, which is generally noted in the botanical report. While stopping at St. Vincent for a few hours for coaling, a good collection of shore animals was made. And here in Port Stanley and the neighbourhood, in the spare time not devoted to the stowing of the ship, a really rich collection of animals has been got together in the

[1] The generic and specific names given in this report must be regarded as provisional, until the complete working out of the *Scotia* collection.—Ed. *S.G.M.*

extremely limited time at our disposal, sufficient to keenly whet the appetite of any naturalist, and to show that the Falkland Islands offer very great opportunities to any zoologist.

During the cruise we have tried various methods of fishing. It is usual on such a voyage as this to catch many of the sea-birds by means of hooks, and it is rather remarkable that we should not have succeeded in securing a single bird in this manner. Sharks, in fact, have been the only creatures secured by line and hook. Whilst lying off St. Paul's Rocks with the ship, the first attempt at using the Monaco surface trawl

Lighthouse—Falkland Islands.

was entirely successful, and on the 20th December 1902 a rich haul of the dredge was made 47 miles NW. × W. ½ W. off Abrolhos light, and traps have been continuously set during our stay in Port Stanley.

Of mammals, whales have only been seen on two or three occasions, though smaller creatures have been seen frequently, notably at St. Paul's Rocks and south of the Equator. None of these were however secured, as the time involved in prosecuting a whale-hunt outside the Antarctic area was not available. The first bird secured was a lark blown off the land. The next birds were two shot at St. Paul's Rocks, namely, the booby (*Sula leucogaster*), and the noddie (*Anous stolidus*), and one of the two terns which are already known to nest on those rocks in great numbers. On the 28th December, in 34° S. 49° W., three specimens of *Oestrelata* (*mollis?*) were shot. At the Falkland Islands specimens of the rock or kelp goose (*Anas antarctica*), the logger-headed duck or

goose (*Anas brachyptera*), also known as the steamer duck, on account of its "extraordinary manner of paddling and splashing upon the water," a heron-like bird called king quail, a white-breasted oyster-catcher (*Haematopus leucopus*?), called curlew by the islanders, though it does not in the least resemble that bird, and also one entirely black (*H. ater*?), two shags, one which is exceedingly plentiful, the Jackass and Rock-hopper penguins, a large hawk, the ringed dotterel (*Aegialitis falklandica*), a snipe resembling the jack snipe (*Gallinago paraguaiae*), two species of small sandpipers, a linnet with greenish plumage, locally called a sparrow, as well as a bird resembling a whitethroat, have been captured. The eggs of most of these birds also form part of the collec-

Capture of large Sunfish.

tion. A considerable number of other birds, such as the black-backed gull (*Larus dominicanus*), the "johnnie rook" (*Senex australis*), a hawk, a thrush, have been seen, but have not yet been captured.

The lizards at Madeira, and a stray turtle seen south of the line, have been the only reptiles met with.

Of fishes, perhaps the most striking capture was a large sunfish (*Orthagoriscus*) weighing half a ton. Several sucker fish were attached to it, but freed themselves before the sunfish was hauled on board. One was secured alive about two hours afterwards, lying in the gills, where parasitic copepods were also found, while the alimentary canal swarmed with tape- and thread-worms, and also contained a leech-like parasite. On the lip was a barnacle, whilst externally the body was covered with a

parasitic copepod (*Argulus* ?), and a *Polycladthus*, so that no less than eight species of animals, all of considerable size, were living in association with this remarkable fish. Sharks were seen on several occasions, but most notably at St. Paul's Rocks, where the water literally swarmed with a species of Carcharias, several examples of which were taken on board. Flying fish (*Exocoetus*) were obtained between lat. 19° 7′ N. and lat. 32° 14′ S., sometimes in very considerable numbers. At Madeira, St. Vincent, and Port Stanley quite a number of fishes have been collected, which will be described at a later date, whilst the tow-net has been the means of capturing young ones.

A considerable collection of invertebrates has already been made, as before mentioned, at Port Stanley, St. Vincent, and by means of the surface tow-net and dredge. This includes several moths caught far from the South American coast.

5. Geological Notes, by J. H. Harvie Pirie, B.Sc., M.B., etc., etc.

So far the opportunities for geological work have been extremely limited; a study of the coastal topography as seen from the ship in passing, and a hurried collecting of rock samples on shore being all that time permitted of either at Madeira or St. Vincent.

Madeira.—The island is a good example of one composed, so far as I saw, entirely of volcanic material, a complex mass of lavas and tuffs in varying proportions. It is comparatively recent in age—probably Miocene—and, though deeply scarred by the torrential streams of the rainy season, has not had all its outlines smoothed down in the way one is accustomed to at home. The actual vent of the volcanic outburst I saw no sign of, and it is not, I believe, to be seen on the island.

The lava beds on the coast near Funchal are comparatively thin sheets, but extend considerable distances laterally, though varying much in dip and direction; the greater part of the land mass is made up of beds of tuff and cinder, varying in colour from purple and red to yellow, and in grain from fine dust to very coarse agglomerate. I should say from the evenness and regularity of their bedding that they have been laid down under water, but I could find no organic remains in any of the beds examined. The lava is chiefly a fine-grained basalt with large crystals of olivine.

A visit was paid to an interesting section exposed on the coast about five miles north of Funchal harbour. Here what appears to be an almost exactly bisected parasitic cone is visible, but the loose nature of the cindery beds prevented me from reaching the upright pinnacle of rock that I took from the deck *en passant* to be the plugged-up pipe, and its relation to the basalt sheet below the ashy beds through which it rises could not be satisfactorily determined.

Some casts of shells were secured from limestone brought from the adjacent island of Porto Santo; no actual shells were got, nor was the limestone seen *in situ*. These Porto Santo limestones are stated by K. Mayer to be of the Helvetian or upper marine stage of the Miocene system, and since they are below the lava and cinder beds, and yet contain

numerous fragments of ash, they give us the clue to the time of the volcanic activity in this neighbourhood, as in all probability these limestones were being formed at the time Madeira was lifting its head above the surrounding waters.

St. Vincent is the wreck of an old volcanic cone, in the crater of which the harbour of Porto Grande is situated; the actual crater is not now visible, probably it stood considerably higher than the present land level, and its site is hidden under barren stretches of volcanic agglomerate and wind-blown foraminiferal sand.

The island is composed of a series of lava and cinder beds dipping outwards on all sides from the centre. These are cut across by a series of dykes also appearing to have a general radiate arrangement, which in many places stand out as huge vertical walls, as they resist denudation more than the surrounding rock. None of the peculiar jointing figured by Moseley in his *Notes by a Naturalist* was seen—no doubt from lack of time to make more extended observations. I was informed by some of the British residents that on the east side of the island there is a well-preserved parasitic cone; this would indicate a third period of volcanic activity. The rocks collected include amongst others: (*a*) Specimens of the rock described by Doelter as "pyroscenite," which has a glassy ground mass with a composition agreeing with nepheline, contains very large crystals of augite, and has numerous amygdaloidal cavities filled with Zeolites and (*b*) What appears to be a basalt rich in Haüyne.

6. Meteorological Notes, by R. C. Mossman, F.R.S.E.

The exposure of meteorological instruments on board ship is associated with many difficulties which do not present themselves at land stations. This applies more particularly to thermometric observations which are liable to be vitiated by heat from the engines and air currents from the galley and cabins of the vessel. On the *Scotia* special attention has been given to this matter in order that the best possible results may be obtained, duplicate methods of observation being employed in many cases. The form of thermometer screen adopted is the small single louvred pattern recommended and supplied by the Meteorological Council, who have by the loan of instruments and in other ways rendered valuable help to the expedition. Two of the screens above referred to are in use, each containing a dry and wet bulb thermometer. They are secured to ports which project clear of the ship's side to the extent of eighteen inches. One is placed on the starboard and the other on the port side well aft on the poop. Both boxes are read at each observation, and the indications of the instruments exposed on the weather side are entered as giving the closest approximation to the true thermal condition of the surrounding atmosphere. A further check is afforded by the records of three Richard thermographs which give continuous records of temperature, on charts coiled around brass cylinders actuated by a clock movement. Some little trouble was at first experienced with the wet bulb thermometers. This was found to be due to saline accretions on the

muslin and bulb of the instrument, such as are formed on every exposed part of a vessel at sea. The result was that in the course of a week or so a coating of salt formed round the bulb which could with difficulty be removed by scraping with a knife, or even dissolved by placing the thermometer in *tepid* water. By changing the water in the reservoir frequently, and placing a fresh piece of muslin on about once a week, thoroughly satisfactory results were obtained, the wet bulb being further syringed daily with distilled water. A Richard hair hygrograph was employed as a check, so that any serious discrepancy between the two instruments was at once apparent. For the measurement of the intensity of solar radiation a black bulb thermometer *in vacuo* was employed. This was fixed in a stand secured to the bridge in such a position that the sun could shine on it as nearly as possible at all hours of the day.

Two barometers of the new marine pattern are in use: one being placed in the deck laboratory at a height of seven feet above the sea, while the other is a spare instrument and is kept aft in the cabin. Three self-recording Richard barographs yield continuous traces of barometric pressure. One of Dr. Black's marine rain gauges is placed aft on the poop well clear of the deck. Its position is changed occasionally as circumstances arise in order that it may always be on the weather side. The exposure—taking into account the various difficulties attending rainfall observations at sea—is a very good one, as the gauge is never sheltered by the sails. The thickness of the rainband in the spectrum of sunlight is taken daily at noon, and the temperature of the sea surface is observed every four hours, and at frequent intervals when rapid changes are in progress. For ascertaining the height of ocean waves a Richard statoscope is employed; this is really an extremely delicate aneroid barometer, in which changes of pressure are magnified twenty-five times. A chart actuated by clockwork receives a trace of the pressure fluctuations due to the rise and fall of the waves, the height of which can thus be readily determined. Aft on the poop is a small machine for reeling in the piano wire attached to box-shaped kites of the Blue Hill pattern. Specially constructed meteorographs made of aluminium are carried up by the kites, and a record of the vertical distribution of pressure, temperature, and humidity is thus graphically recorded. The expedition is well equipped with sunshine recorders and other special instruments for use in high latitudes at the winter station which is to be established. Observations four times daily were commenced immediately after leaving Kingstown, but on reaching lat. 30° S. hourly observations were initiated, and these will be continued until the termination of the expedition. The results of these observations, taken by night as well as by day, should form an interesting contribution to Antarctic meteorology, especially as regards the diurnal range of the climatic elements over an ice surface.

The weather during the voyage to the Falklands was fine and dry, rain falling on only fifteen days, the total recorded being 2·87 inches. Of this quantity practically half fell in one or two heavy showers on December 7th and 8th, about lat. 3° to 6° N. It was interesting to note the regularity of the diurnal range of barometric pressure in tropical and sub-tropical regions. Between the parallels of 15° N. and

30° S. the temperature was high and equable, ranging from 75° to 82°, the relative humidity was comparatively high and the thickness of the rainband a marked feature in spite of the small precipitation. A rapid fall of temperature took place on December 29, when in lat. 35° S. and long. 50° W., and on this day and the one following a moderate gale blew from the south accompanied by a low relative humidity. Lightning was frequently observed, and was essentially a nocturnal phenomenon. Only one thunderstorm was noted, viz. on January 4, when in lat. 47° S. long. 57° W. The green flash was seen on two occasions, being specially marked at sunset on December 18. The earth shadow was also noted on several occasions, and shooting stars were unusually numerous from 18th to 21st December.

Note by the Hon. Secs. of the Royal Scottish Geographical Society.

In addition to the foregoing, the members of the Expedition have sent home a considerable amount of material, giving in detail the results of the numerous scientific observations on the temperature, density, colour, and so forth of the sea during the voyage. Much of this material will not be fully available until the whole results of the Expedition come to be worked out, but the amount of work done on the voyage shows not only the energy and devotion of the members of the Expedition, but also the value and completeness of the equipment. Under these circumstances it is eminently desirable that the *Scotia* should be enabled to spend a second year in the Antarctic, in order that the staff may have every opportunity of carrying out an extended series of observations, and of co-operating to the fullest possible extent with the other Expeditions, with whom the *Scotia* is acting in concert.

Mr. Bruce, in his last letters before sailing from Port Stanley, makes an urgent appeal for the further financial assistance necessary to enable the Expedition to carry out this programme. He says :—"It rests with those at home to say whether we are to give another year's work to the scientific investigation of the Weddell Sea, and we accordingly look to the enthusiasm of Scotland to raise another seven or eight thousand pounds for this important object. The Expedition is now no longer problematical ; the ship, the men, and the equipment are all ready to carry on the work, we merely require funds for working expenses." Mr. Ferrier, the Secretary of the Scottish National Antarctic Expedition, has supplied the following general financial statement, signed by Mr. Thomas B. Whitson, C.A.:—

"*March* 5, 1903.

Paid for ship, equipment, organising, wages, etc., to date,	£23,866
Accounts outstanding rendered, say, ...	1,000
Salaries of Staff and wages of Crew for twelve months, .	4,220
Incidentals, freights, coal, etc., ...	120
Total estimated outlay for the first year's work, . .	£29,206
Amount received in subscriptions to date, . . .	26,695
Balance still to be collected for first year's work, . .	£2,511

From the knowledge we have at this date, we estimate that the Expedition could be kept out for about twelve months from March 1904 for a further sum of

£6000, and in order that the scientific results may be worked up, the total sum now required is £10,000.—T. B. Whitson, C.A."

The Council of the Royal Scottish Geographical Society is fully convinced of the importance of another year's work in the Weddell Sea. Taking into consideration that the Expedition is now fully equipped, it is most desirable that the necessary funds to cover working expenses should be supplied to enable it to fully realise its object. The Council asks the assistance of members of the Society in this important work. Subscriptions will be received by Colonel Bailey, Secretary of the Society, at the Society's Rooms, Queen Street, Edinburgh.

Ralph Richardson, }
J. G. Bartholomew, } *Hon. Secs.*

A VISIT TO THE ISLAND OF SAKHALIN.[1]

By Charles H. Hawes, M.A.

The Siberian island of Sakhalin, or Saghalien, as it is sometimes spelled, lies at the mouth of the river Amur, and is separated by the narrow Straits of La Pérouse from Yezo, the northernmost of the larger islands of Japan. I approached it from that country, and, landing at Vladivostok, reached Khabarovsk on the Amur by means of the Ussuri railway. Thence I descended this great river for 623 miles, as far as Nikolaevsk, 27 miles from its mouth. Here, with another passenger, a Russian engineer, and 300 convicts, I was stranded, but ultimately, by the timely aid of a German tramp steamer, I got away, and was landed at Alexandrovsk, on the west coast of Sakhalin.

The sandbanks at the mouth of the Amur, and to the north and south of the Straits of Tartary, offer great difficulties in the way of navigation. Our vessel had to proceed throughout at half-speed and with anchor ready to let go. At one spot in the tortuous and narrow channel, only 13 feet of water is available at neap tide. On reference to the map it will be noticed that the Straits of Tartary narrow at one place between Capes Lazarev and Pogobi to a breadth of about five miles. It seems probable that a neck of land once united the two, and so made Sakhalin a peninsula. The Gilyak natives tell an interesting legend, one of those curiously prevalent deluge stories, which describes the submergence of this neck of land. A similar cataclysm, which occurred further north and is historical, was described in 1813 by Peter Dobell—this was the insulation of the town of Okhotsk. The strange mixture of sub-arctic and sub-tropical plants and animals in Sakhalin seems to lend support to the theory, for in the antediluvian period the Kuro Siwo, or warm current of the east, would have probably washed the coast of the Primorsk and of W. Sakhalin unhindered by the cold current from the north which now forces it back. The form of the alluvial deposits immediately to the north of the funnel of the Straits also seems to favour this hypothesis.

The island is 588 miles long, and varies in breadth from 17 to

[1] An address delivered before the Society on February 25, 1903.

100 miles. It is mountainous, with one long ridge or backbone averaging about 2500 feet in height, and rising to its greatest altitude in Mount Itchara (4860 feet). There are a great number of torrential streams, but only two rivers of any note. These are the Tim (Gilyak, Tim = cranberry), and the Poronai (Ainu, Poro = big, and nai = river), each with a course of about 300 miles, the former flowing north and finding an outlet on the NE. coast, the latter with the same watershed running south into the Bay of Patience.

A Gilyak "dug-out" canoe.

The island is cliff-girt on its southern half, except at certain spots in the Bay of Patience, but on the NE. and NW. coasts low swamps, the "tundra" of the north, border the sea.

Geologists have been hoping to find traces on Sakhalin of a recent volcanic origin, but it would seem more probable that while the line of volcanic action runs down from Kamtchatka through the Kurile Islands and Japan, Sakhalin represents the remaining outcrop of the line of weakness. Although it is in the main composed of Tertiary rocks, I have observed hardened ferruginous marl containing huge Ammonites, which prove its secondary origin. Perhaps the commonest rock-

exposure observed consisted of conglomerate, resting on hard argillaceous sandstone.

Four days were consumed at Alexandrovsk in preparation for an expedition to the north-eastern coast of the island. I had the good fortune to find a convict, a man of rank and education, who was allowed to accompany me as interpreter. Arms, furs, canvas, articles of food and barter were laid in, and a start was made for the interior. The roads and forest-tracks were unsafe owing to "brodyagas" (escaped convicts), and it was necessary to have our guns always ready, as many of the outlaws were armed with rifles. On the second day after the start, the forest-track gave out, and further progress was only possible by river. We then descended the river Tim, in a native canoe dug out of a poplar trunk, to its mouth, a distance of 193 miles, which took six days. The width of the river increased during our progress from about 100 to 500 feet, but except for a few miles above the mouth, the water is very shallow. In the upper reaches it required great skill on the part of our Gilyak natives to steer the light craft over the shallows, and through the rapids.

The banks of the river were for the most part forest-clad, as is indeed the greater part of the island. The commonest trees in the northern half of the island are the larch (*Larix dauriea*) and the birch; in the southern half the spruce (*Picea ajanensis*) and the fir (*Abies sachalinensis*). On our way over the backbone of the island and through the forests towards the river Tim, I had observed the elm, rarely the wych elm (*Ulmus montana*), nut trees (*Panax ricinifolia*), maple, and mountain ash (*Pyrus aucuparia*). The hedges were gay with the fruit clusters of the red-berried elder (*Sambucus racemosa*), and on the skirts of the forest wild raspberries and Spiraea (*betulaefolia*?) were very common. The last-named dislikes the company of the needle-bearing trees, and flourishes in the company of the birch and larch.

On the banks of the river poplar and aspen, occasionally seen on our overland journey, were quite common, as were also willow (*Salix macrolepis*) and alder. The undergrowth also included more "berried" bushes. In addition to the beautiful wild rose (*Rosa rugosa*) were the cloudberry (*Rubus chamaemorus*), the cranberry (*Oxycoccus palustris*), the crowberry (*Empetrum nigrum*), and the red whortleberry or cowberry (*Vaccinium vitis idaea*).

The flora of Sakhalin represents a link between those of Japan and of Siberia. The trees and plants enumerated above are mostly found in the Siberian "taiga," but many of those occurring more commonly in the south of Sakhalin are included in the flora of Japan. Among these are the spindle tree (*Euonymus macropterus*), hydrangeas, the vine (*Vitis thunbergii*), the cork tree (*Phellodendron amurense*), and the bamboo (*Arundinaria kurilensis*). A noticeable feature in connection with the distribution of these is that the last-named is found over large areas on mountain slopes, alongside of the birch (*Betula ermani*), and only just below the gnarled wood region of the Swiss pine (*Pinus cembra pumila*).

In descending the Tim and proceeding along the north-eastern coast, I had in view a short study of the interesting native tribes, and

chiefly the Gilyaks, who inhabit this region. Strings of dried fish, or the yelpings of sledge dogs, announced to us the proximity of a native village, as our canoe shot round the bend of the river. At such tiny villages, for they generally consisted of about half a dozen huts, we stopped to barter and get information, and later, when we reached the coast and found rather larger collections of huts, we became the guests of the headman, sleeping on the fishskins or reindeer skins spread on

The Headman of Newa and his two Wives.

the place reserved for the honoured, amid the score of other inhabitants of the house.

Three different tribes were met with in our wanderings: the Gilyaks, who are the most numerous, the Orotchons and the Tungus. In the south are 13 Yakuts and about 1300 Ainus, these latter akin to the native population of Yezo. The Ainus were the earliest arrivals of the five tribes enumerated above, but discoveries have been made which suggest an even earlier race. In hollowed ground spaces—supposed pit dwellings—have been found diorite and obsidian implements and clay potsherds, and the Ainus, declaring their ignorance of these and any such craft, give the name of Tonchi or Toitchi, *i.e.* clay-bakers, to their

makers. The analogy with the Koro-pok-guru or dwarf pit-dwellers of Yezo is obvious.

The Ainus are a patriarchal-looking race with abundant hair, and their presence among Mongolian races with a notable absence of it has led to exaggerated statements. Like the tribes of the north of Sakhalin, they live by fishing and hunting, but they are considerably less wild than these, and possess a knowledge of weaving, unknown among the Gilyaks, etc.; they make use of the fibres of the nettle in the process.

The tribes of the north may be classed as of semi-Tungus, semi-Mongol stock. The Gilyaks still retain their pigtails, while the Tungus, who have cut off theirs under Russian influence, are the wildest of the tribes and the best hunters. The most civilised branch of the Tungus race to-day is the Manchu, which has for two and a half centuries given China its ruling caste.

These Sakhalin peoples are veritable children of the forest, which with the river and sea supplies them with their food, clothing, and gods. The Great Creator is above all, but "Kiskh," as he is called, is confused with his agents Pal ni vookh, the god of the mountains and forest, Tol ni vookh, the god of the sea and rivers, and Toor ni vookh, the god of fire.

Tol ni vookh sends them their chief means of subsistence and clothing, the salmon (*Salmo proteus* and *lagocephalus*) and the seal (*Phoca vitulina* and *nummularis*). Salmon dried in the sun (*yukola*) forms their winter provision, and the skin scraped, pounded, and dried does duty for summer dress, though this material is gradually giving way to Chinese cloth (*ta-pu*) which is slowly penetrating into the wilds. The seal is chiefly valued for its oil, a great delicacy which renders palatable the most revolting leathery scrags of six-months-old fish. The skin of this (the hair-seal) serves them, especially the women, for winter clothing.

The fur seal (*Callorhinus ursinus*) and the sea-otter (*Enchydris marina*) are both very rare now. The white whale (*Delphinapterus leucas*) is considered a great friend of the natives, for this wolf of the ocean drives in before him the salmon seals, all manner of small fish, and on rare occasions the huge carcass of a whale slain in an onslaught of these murderous dolphins. During the summer the fish arrive in "posts," as the natives say, the herring, the trout, the turbot, and smelt.

Having reached the mouth of the Tim, I found there a curious delta formation. For a hundred miles, and probably for another fifty or seventy miles along the as yet unexplored coast to the north, stretched a series of lagoons—bays, I ought rather to call them, for the long and narrow sand dune was pierced about every twenty miles by a narrow strait giving entrance and exit to the tide. A similar formation occurs on the NE. coast of Yezo, and would seem to have been caused by the check produced by the strong Okhotsk cold current flowing south, on the alluvium laden waters of the Tim, with a consequent deposition.

Entrance into the Bay of Ne, into which the Tim discharges its

waters, was possible for small brigs, but to the north the water became so shallow that it was with the greatest difficulty that our craft, drawing but 3 or 4 inches of water, could be dragged through. At latitude 53° N. we were compelled by storm and by the necessity of making sure of means of retreat to turn back. It was here along this NE. coast that we saw the Siberian "tundra." This was the haunt of the reindeer, and we saw them cropping the lichen that grew in snow-like patches over the swampy ground. With a subsoil eternally frozen, the surface of the tundra is a stretch of meres and swamp covered with coarse dank grass, gnarled and stunted bushes of larch and birch and low clusters of berry-laden bushes, in summer a region shrouded in sunlit mist, but in winter a frozen waste over which the Tungus, clad in skins, course with their reindeer sledges. Returning again to the mouth of the Tim, we found there our river crew with a message transmitted through natives by the Russian police, stating that five convicts had escaped from the Rikovsk prison, three of whom were armed with Winchester rifles, and were descending the river with intent to murder our hosts in the Bay. To this was added the warning to fire at any Russian we might see in the forest. Camping that night just above the mouth of the river, amid shelterless swamps, the sound of paddles was heard, and a canoe manned by five Gilyaks shot into our temporary haven. They also were bound up the river, and under the circumstances were desirous of our company. Their object was to buy a bear of their brethren of the village of Ada Tim, and they had with them their purchase-money, which consisted of a dog and a piece of brocaded satin, the last probably obtained for sable skins from some wandering Japanese brig.

On land the big brown bear (*Ursus arctos*) fills the greatest *rôle* of any animal among the Gilyaks. They capture it, if possible when young, feed, bathe, promenade it, and house it in a strong log cage. At the age of four the animal is the subject of a great festival, probably religious in origin. The bear is adjured to give a good account of the tribe to the great Pal ni vookh, is directed the way his spirit should take, and two dogs are then killed in order that their spirits shall hunt his to the great lord of the mountains and forest, and he is finally shot by an archer. A great feast followed by games then ensues.

Wolves are no longer met with in large packs, but foxes are plentiful and include both the red and the black varieties. It is however the sables and otters that are particularly the prey of the native snares and traps. The reindeer, musk deer, hares, squirrels, mice, and rats all occur on the island, but the tiger, notwithstanding all reports to the contrary, has never been observed in Sakhalin. It is however true that to-day he still crosses the Amur on the ice as far north as latitude 51°.

Late autumn still found us on the Tim with most of the birds migrated. Wild swans, geese, and wild ducks had nearly all departed, and our larder was being rapidly reduced to its prime factors. The monotony of a cup of boiled rice and a lump of sugar three times daily was only relieved by our natives shooting a seal.

Seabirds were in great numbers on the island, including the cormorant, osprey, guillemot, crested auk, gulls, etc. Along the river,

wild geese and wagtails were commonest, but I noted a considerable variety of other birds, such as robins, finches, larks, nutcrackers, jays, carrion crows, woodpeckers, kingfishers, sandpipers, snipe, and several white-tailed eagles. In addition to these I heard the snowy owls, and the following have been observed—fieldfare, water ouzel, swallow, raven, cuckoo, plover, wren, etc. etc. A careful classification gives twelve per cent. of the birds as sub-tropical and fifteen per cent. circumpolar, the rest being found in Siberia, Europe, and the North Pacific.

Winter had laid its mantle of snow on the tops of the mountains before our six hundred miles' canoe journey had ended, and in the course of a day (Sept. $\frac{1}{2}$), the thermometer fell from 64° to 24° F. The range of temperature in the island is very great, and for the year 1900 the records at Alexandrovsk showed a range of 119° F., from 81° in July to −38° in January. In the interior, at Rikovsk, this range was increased to 129½°, with a record fall of −49°. The range of the average monthly readings is rather less than that of Khabarovsk and Tchita on the mainland. Snow falls on about 96 days in the year, and remains for six to seven months, usually attaining a depth of from 1 to 3 feet, while depths of 7 feet are quite common. The total annual rainfall is less than that of England, a sixteen years' average giving 22⅝ inches. Fogs are much less frequent on land than at sea; the average number of days on which fog has been observed at Alexandrovsk being 27. Any modifications of continental climate which we should expect on the island are balanced by the local conditions. The prevailing winter winds are from the N. and NW., and those of the summer from the S. and SE., whence we may say that Sakhalin has its monsoons. Winter finds one vast stretch of ice from the Okhotsk Sea to Sakhalin, which a cold current from the northerly regions has helped to envelop in Arctic frost. In 1900 the days on which frost occurred were 208, and on 141 of these no thaw took place.

The vegetation period varies with latitude and locality, but averages rather less than one hundred days; it is thus not surprising that agriculture is at a low ebb. I have seen oat crops yielding two or three fold, and a report from the village of Slavo, where our canoe journey began, gave a yield of eleven grains of wheat for every ten sown. But the average for the whole of the cereal crops was for 1898 a 6·35 fold crop.

A late spring and early frosts are against the cultivator, but more serious are the laziness and indifference of a criminal population, which feels no love for their island-prison, and a want of care on the part of the officials in the selection of arable districts. Potatoes and a few other vegetables are grown in parts with success, the average crop of the first being 7·73.

The industries of Sakhalin are very few. Coal-mining proceeds slowly and by crude methods, though as a steam coal the product is superior to that of Japan. Fish is caught in very large quantities in the south of the island, and is prepared as guano and shipped to Japan for use in the paddy fields. Bêche-de-mer and seaweed are also gathered for the Chinese market. Some oil-wells and lakes have been discovered

on the north-eastern coast, but I do not expect, after visiting them, any great development. Sakhalin still yields large quantities of furs, *i.e.* the skins of otters, bears, foxes, sables, squirrels, reindeer, etc., which are taken by the natives on dog-sledges across the frozen straits to Nikolaevsk.

The island is so convenient a dumping-ground for convicts, and the difficulties of escape from it are so great, that it is hardly to be expected that the Russian Government, with large areas of ground as yet untouched, should go out of their way to develop Sakhalin. Other difficulties face individual enterprise, for the pioneer and his staff have to live in an atmosphere of criminals, and on an island where there is no security for life or property; so that it cannot be said that the future prospects of Sakhalin are bright.

THE TANGANYIKA PROBLEM.[1]

Mr. Moore's new volume will be welcomed by all geographers, as it sums up much information which has hitherto been scattered in the Magazines and Journals of the Scientific Societies. All this material is now available in the form of a connected narrative, so that the solution which Mr. Moore offers of the "problem" is clearly set forth. Before proceeding to the consideration of this solution, it may be well for the benefit of those who have not followed the Tanganyika question closely to state the "problem" as it has disclosed itself through the efforts of successive explorers.

Tanganyika was discovered by Sir Richard Burton, and his companion Speke picked up some shells on its shore which ultimately found their way to the British Museum. These shells, which were supplemented by further collections made by missionaries, proved on examination to be curiously marine in character. So much was this the case that Mr. E. A. Smith in describing them suggested that their presence in Tanganyika might prove to be the result of a former connection between that lake and the sea. The interest of this suggestion was greatly accentuated when the German traveller, Dr. Böhn, announced the discovery of such characteristically marine animals as jelly-fish in the waters of Tanganyika. Böhn's discovery was confirmed by others, and, as a result of the interest aroused, the first Tanganyika Expedition with Mr. Moore at its head set out in the autumn of 1896. The Expedition obtained large collections of the aquatic animals of Tanganyika, and found that within the waters of this lake there occur a whole series of animals distinctly marine in type. These animals are accompanied by a series of ordinary fresh-water forms similar in character to those which occur in the other lakes. The first series, those of marine character, constitute what Mr. Moore calls the "halolimnic fauna," and after the

[1] *The Tanganyika Problem.* An account of the researches undertaken concerning the existence of marine animals in Central Africa. By J. E. S. Moore, F.R.G.S., author of *To the Mountains of the Moon.* London: Hurst and Blackett, Limited. 1903.

first expedition he pointed out what seemed to him the striking resemblance between some of them and certain fossils of the Jurassic Age. He therefore suggested that Lake Tanganyika would prove to be a remnant of a Jurassic sea. This suggestion however is not in harmony with the conclusions as to the geology of Africa which had been previously held by experts. Sir Roderick Murchison indeed maintained in 1852 that the interior of Africa had never been below sea-level. Even if this extreme position were given up, the fact that the fauna of most of the great lakes of the African interior was quite unknown, make it impossible to come to any conclusion as to the direction in which Tanganyika had communicated with the sea, if it ever did communicate with the sea. To put the matter in another way, at the end of the first Expedition it was definitely known that Tanganyika contained a fauna regarded by naturalists as "marine" in character; but it was not known whether this fauna was entirely peculiar to Tanganyika, or whether it occurred in any other of the great lakes. The first expedition had ascertained that this peculiar fauna was absent from Lakes Nyassa and Shirwa, but nothing was known of the fauna of Lakes Kivu, Albert Edward, Albert Nyanza, Victoria Nyanza, and Rudolf. Further, legitimate speculation as regards Tanganyika was rendered impossible by the fact that the geology of the district was almost unknown, as was also its physical geography. In order to fill up these gaps in knowledge—zoological, geological, and geographical—the second Tanganyika Expedition was organised, and, aided by a grant from the Royal Geographical Society of London, was enabled to set forth in the spring of 1899 under the leadership of Mr. Moore. It is the results of this second Expedition which are discussed in the volume before us. Apart however from its primary purpose of discussing the problem of Tanganyika, the book contains some exceedingly interesting chapters on the general geography of the African interior. It is these chapters which will appeal most to the geographer proper. It may be said generally that far from finding that the geological structure of the African interior is in direct opposition to the view of a former connection between Tanganyika and the sea—as has been stated by geologists—Mr. Moore believes that the geological and zoological evidence alike confirm this view. It has been said that the Tanganyika problem affords another example of the not infrequent conflict between zoologist and geologist, but Mr. Moore considers that the observations of the second expedition show that here at least the geologist's opposition must yield before fuller knowledge.

First, as regards the structure of the interior of the continent of Africa, Mr. Moore opposes *in toto* the current view that in its broad physical features the equatorial region has been absolutely stable throughout long ages. He regards Africa as constructed in relation to an elevated ridge, running from the mountains of Abyssinia in the extreme north to the Drakensberg in the extreme south. In some places, as in the region of Tanganyika and the Albert Edward Nyanza, this central ridge is broad, and forms the culminating line of two slopes from the east and the west, rising so gently from the bounding plateaux

that it does not appear as an actual mountain chain on either side. In other regions, as between Nyassa and Tanganyika, the ridge rises as abrupt mountain chains from the surrounding country. To the ridge throughout its extent Mr. Moore has given the name of "The Great Central African Range," and he regards it as bearing the same relation to the African Continent as a whole as the Andes do to South America. From the Great Range the main rivers of the continent flow east and west, but from a variety of causes the greater rivers drain from the western slope, this being especially the case as regards the great river system of the Congo.

As in the other great mountain ranges of the globe, the ridges of the Central African range enclose long depressions, parallel with the ridges, and now containing the great lakes or river valleys. These great depressions are often rock valleys, and are to be regarded as the products of the same causes which produced the mountain chains themselves. Again, as in the case of the other great mountain chains of the world, we find that the movements of elevation which led to the formation of the range have induced outbursts of volcanic activity in the vicinity of the range. Just as we have the Auvergnes and the cones of the Puy de Dôme in relation to the Alps and Pyrénées, Etna, Vesuvius, and Stromboli in relation to the Apennines, so we have the Mfumbiro Mountains, Kilima-Njaro, and other volcanoes in relation to the African Central Range. In brief, Mr. Moore believes that there has been elevation on the grand scale in Central Africa, and that the depressions in which lie the great lakes—the Gräben or Rift-valleys of Suess—are to be regarded as surface wrinkles produced during the process of elevation of the adjacent mountains. We cannot enter here in detail into the evidence upon which Mr. Moore bases this view; it may suffice to state that he supports it by a number of sections across the great lakes, whose object is to show that from the nature and relations of the rocks this is the only feasible hypothesis. As he regards the valleys as due rather to folding produced by lateral pressure than to vertical subsidence, he prefers the term "Eurycolpic fold" to the current name of rift-valley. The remarkable network of these folds found in equatorial Africa Mr. Moore regards as unique on the globe, and compares to the canal-system visible on the surface of the planet Mars. Whereas in other parts of the globe the surface features have been hugely modified by the processes of denudation, Mr. Moore believes that in Central Africa we "are dealing with a unique example of the initial stages in the shaping of a continental mass," striking in its extraordinary simplicity and primitive boldness.

In regard to the superficial geology in the regions of the great lakes, it is unnecessary to point out that this as yet is but imperfectly known. Nevertheless, recent discoveries have shown that there exist in Central Africa a very extensive series of aqueous deposits of different ages. These deposits shed much light on the past history of the interior of the continent. In the Nyassa region there are three sets of sedimentary rocks. Beneath the modern lake deposit lies first a slightly disturbed chalky limestone, apparently of Pleistocene Age. Below this are found masses of blue and grey rocks, which were discovered by Henry

Drummond, and from their contained fossils have been referred to the Triassic period. Below these are a much older series of beds, probably of marine origin, and of great thickness and extent. To these three series of beds Mr. Moore gives the names of (1) African Lake Pleistocene, (2) Drummond's Beds, and (3) Old African Sandstone Series. The last-named are of enormous thickness, in some places more than 3000 feet, and they now cover an area to be estimated in millions of square miles. Their presence undoubtedly shows that Central Africa must have formerly been covered by waters of great depth and extent, within which these beds were laid down. In all probability certain of the granitoid ridges of the present Highlands formed islands in this great area of water. Subsequently elevation took place in the area, and with the gradual rising of the "Great Central Range" the beds of sandstone became faulted and broken. While these changes were taking place, the beds known as Drummond's Beds were laid down in certain parts of the retreating waters, and their presence marks the limits of the dwindling sea. As these beds seem to be of Triassic date, the formation of the "Great Central Range" must be referred to that geological period.

So much for the general outline of the geology of the region. Considering the lakes more in detail, we find that in the Nyassa region there is no evidence that in its southern districts the country had been disturbed since it acquired its present character. It is otherwise in the north. Here there is evidence that great structural changes have been going on for a prolonged period. The lake bed has been and still is extending northward owing to gradual depression. In this northern region Drummond's Beds occur, and as they contain a marine fauna, they show that the sea must once have extended to this region. No trace of a marine element now exists in the fauna of Nyassa, but there must formerly have been a body of water in its northern region which existed prior to the present northward extension of the lake, and which had a communication with the sea. Now the valley in which Nyassa lies is continued into that of Lake Rukwa, and the valley of this lake runs into the great trough of Tanganyika itself. The fauna of Rukwa is known to be peculiar, but it is not yet known whether it does or does not resemble that of Tanganyika. But it is clear, that in the region of the north end of Nyassa there once existed a marine fauna of Triassic and Jurassic date, and that the fold in which this part of Nyassa lies is continued into that of Lakes Rukwa and Tanganyika. The present lake of Tanganyika, as already stated, contains a fauna which resembles that of the seas of the Jurassic period, and the above account of the geology of the region suggests that this is because the present Lake Tanganyika is a remnant of the sea which in Triassic or Jurassic times flowed over Central Africa. From the nature of the valleys it is certain that this great sea retreated westwards, and in all probability eastwards as well. In brief, Tanganyika is the remnant of a sea which extended from east to west across Africa.

The proof that this is the case is of great interest, because at first sight it might have seemed more probable that the lake is the remnant of a great arm of the sea which stretched inward from the north. This suggestion had indeed been made by Suess, and has only been disproved

by the observations on the geology of the region north of the lake made by the second Tanganyika Expedition. Before the return of this Expedition the region lying to the north of Lake Tanganyika, and including the great lakes of Kivu, Albert Edward Nyanza, and Albert Nyanza, was very imperfectly known. As a result of the labours of the Expedition, Mr. Moore is now enabled to give a summary account of the geological topography of this region.

The Expedition found that the great valley in which Tanganyika lies extends many miles northwards beyond the limits of the present lake. A study of this valley showed that not only has the water-level of the lake fallen, but the floor of the valley has itself actually been raised. The valley gradually rises as one approaches Lake Kivu, which stands at an altitude of 4801 feet. The outflow of this lake rushes away through a steep gorge as the Rusisi river, which eventually opens by five mouths into Lake Tanganyika. The rocks composing the Rusisi gorge consist of schist and gneiss, and these rocks occur also on the eastern, western, and southern shores of the lake. To the north, however, the rocks consist wholly of modern volcanic materials which have been ejected by the still active Mfumbiro Mountains. These mountains form a vast transverse dam, closing in the northern end of Lake Kivu, and separating that lake from the southern extremity of the Albert Edward Nyanza. The valley, however, in which Lake Kivu lies is not interrupted by this dam, but sweeps onward to the north, and forms the trough in which lies the Albert Edward Nyanza. This lake has now no connection with Lake Kivu, and lies 2000 feet lower, but Mr. Moore believes that the two lakes were formerly in connection. The formation of the modern volcanic dam has resulted in the banking up of the waters of Lake Kivu, until finally its waters flowed over the high ground separating it from Lake Tanganyika, and drained into that lake in the form of the Rusisi river. If this be so, then enormous changes must have taken place in the drainage of the African interior within recent times.

To the north the effect of the formation of the volcanic dam would be to cut off the whole drainage area of Lake Kivu from the Albert Edward Nyanza, and so from the Nile. Mr. Moore believes that this change has taken place within the last ten thousand years, and accounts for the gradual shrinkage of the upper waters of the Nile, a shrinkage which is recorded both in the physical geography of the region and in history and tradition. Only less important have been the changes produced towards the south. The whole drainage of Lake Kivu has been added to that of Lake Tanganyika. The outlet of Lake Kivu (the Rusisi river) is five or six times bigger than the outlet of Tanganyika itself; so that if Kivu no longer drained into Tanganyika, that lake would cease to overflow. Mr. Moore considers it probable that after the formation of the volcanic dam between Kivu and the Albert Edward Nyanza, the outflow of water from Kivu drained into Tanganyika for a great number of years, until the level of that lake was so raised that it in its turn was able to cut a channel for its outflow to the west into the Congo. This would account for the fact that the water-level in Tanganyika has recently fallen.

If we follow the great Eurycolpic fold to the north we find that its character does not alter until we reach the northern end of the Albert Edward Nyanza. Here a new feature presents itself in the shape of the great range of the Mountains of the Moon. These mountains Mr. Moore believes are to be simply regarded as "a more vigorous and local expression of the flanking mountain chains which appear along the sides of the Eurycolpic folds in other places," and are not, as has been suggested, block mountains due to double faulting.

The general conclusion then is, that while there is no evidence that Tanganyika had a former extension to the north, there is evidence that it did extend to the west along the Congo depression, and communicated in this direction with the sea.

The greater part of the remainder of the volume is concerned with a detailed account of the zoology of Tanganyika and other great lakes, together with a discussion of the origin of fresh-water faunas in general. In its present form this discussion lies purely within the province of the zoologist, and cannot therefore be considered in our pages. The aim of this article has been to draw the attention of geographers to the extremely interesting questions which have been raised by Mr. Moore's volume. With criticism, therefore, in the strict sense we have little to do. It is difficult, however, to avoid expressing a doubt whether the interests of either zoology or geography are served by the inclusion of technical descriptions of the lake animals in a volume whose earlier pages professedly appeal to the non-specialist. Further, there is a considerable want of care displayed not only in the general arrangement—which often involves needless repetition—but in actual composition. We have noticed many sadly mutilated sentences, some devoid of subject, and some of finite verb, while yet others extend to intolerable length. But these are minor blemishes in a work of great and general interest. The book is admirably illustrated, some of the sketches being of very considerable artistic merit. It is altogether a notable addition to the publications of the year.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a meeting of Council held on the 5th March, the undermentioned ladies and gentlemen were elected members of the Society, viz.:—

Anna, Countess of Moray.
Mrs. E. Garriock.
Miss E. Sandeman.
Captain D. Baird.
Rev. Robt. Johnstone.
William Smith, Advocate.
T. R. Gillies.
William Mackenzie.
Wm. M. Sellar.
James Davidson.
Wm. Yorston Nicolson.
John Gordon, M.D., C.M.
William Garden.
James Bisset.

Meetings in February.

On the 24th February, in Glasgow, Mr. C. H. Hawes, M.A., read a

paper on his recent visit to the Island of Sakhalin. The Chair was taken by Dr. Paul Rottenburg. Mr. Hawes read the same paper in Edinburgh on the 25th, when Sir John Murray, President, was in the Chair; he also read it in Dundee on the 26th, when Principal J. Yule Mackay presided; and in Aberdeen on the 27th, when Mr. James Spence occupied the Chair.

Meetings in March.

On the 5th March, in Edinburgh, Mr. J. S. Flett, M.A., D.Sc., of H.M.'s Geological Survey, addressed the Society on the Recent Volcanic Eruptions in St. Vincent and Martinique. The President, Sir John Murray, K.C.B., was in the Chair. Dr. Flett repeated his address to the Glasgow Branch on the following evening, when Mr. Robert Blyth presided.

On the 20th March, in Edinburgh, Mr. A. J. Herbertson, Ph.D., read a paper on the Volcanic Scenery of Central France. Professor James Geikie occupied the Chair.

On the 23rd March, in Dundee, Dr. Wm. G. Smith, of the Yorkshire College, Leeds, read a paper on the Botanical Survey of Scotland, with special reference to the Dundee District; Professor D'Arcy Thomson, C.B., M.A., presided. Dr. Smith read a similar paper in Edinburgh on the 26th, when he dealt principally with the counties of Forfar and Fife. Mr. H. M. Cadell was in the Chair.

GEOGRAPHICAL NOTES.

EUROPE.

The Atlantis Problem.—Dr. R. F. Scharff discusses in detail the fauna of the Atlantic Islands, in its bearing on the question of the existence of a former connection between these islands and Europe on the one hand and America on the other. As is well known, Dr. Alfred Wallace maintains that there is no evidence whatever of any such land connection in former times, and regards the Atlantic Islands as truly oceanic in type. Apart from a special study of the beetles of Madeira, Dr. Wallace put forward three lines of argument in support of his position: first, that the islands are composed exclusively of volcanic rocks; second, that they are surrounded by great depths of water; and third, that they contain no indigenous mammals. In regard to the first of these, it is pointed out that the fact that only volcanic rocks are discernible does not exclude the possibility that the islands may be a remnant of a submerged continent, a view which is indeed supported by some geologists. Again, the statement that the islands are surrounded by deep water is only partially correct, for the Gettysburg Bank has been shown to exist in the vicinity of Madeira, and there is reason to believe that a submarine ridge once connected that island with the coast of Portugal. The whole question further is bound up with the theory of the permanence of the great ocean basins, a theory about which geologists are by no means agreed. In regard to the point of the absence of indigenous mammals, Dr. Scharff has made some historical investigations which seem to show that the rabbit and the goat are truly indigenous, and were not introduced by Europeans, as has been commonly

assumed. Even if this could not be proved, however, negative evidence derived from the assumed absence of mammals could not outweigh positive evidence derived from the presence of invertebrates, and this evidence is believed by Dr. Scharff to be abundant. Dr. Scharff does not believe that there was any direct connection between America and the Atlantic Islands, but he believes that these islands were connected with Southern Europe, and that a land bridge stretched between Africa and South America. As there was frequent intercourse between North Africa and Southern Europe, this would allow of indirect communication between Madeira and South America. We cannot here follow Dr. Scharff into his detailed discussion of the fauna of the Atlantic Islands and its apparent relations, both to European and South American forms; it may be sufficient merely to emphasise the interesting nature of his conclusions.—*Proceedings of Royal Irish Academy*, vol. xxiv.

Zoological Exploration in the Baltic.—In *La Géographie* for February 15, M. Charles Rabot gives an account of some dredging operations undertaken by Johann Gunnar Andersson in the Baltic Sea. In certain parts of that sea there occur depressions of limited extent, which are much deeper than the surrounding areas, and in which the water consequently tends to stagnate. The percentage of oxygen is greatly reduced, sometimes to vanishing-point, while the percentage of carbonic acid on the other hand is greatly increased. But in spite of these facts it has been found that these depressions are not devoid of life, but do contain some organisms, notably certain ostracods. Of these three do not occur anywhere else in the Baltic area, and are characteristic of water of high salinity. But it does not appear that their presence in the depressions merely indicates that the water there possesses a high salinity. Rather their presence is to be explained as follows:—During the Pleistocene period the Baltic possessed a much higher salinity than at present; owing to this fact the ostracods under consideration were enabled to penetrate into it from the open water. With the gradual freshening of the water the Baltic generally became unsuited to them, and they succeeded in persisting only in the depressions, where the exceptional conditions offered an especially suitable medium.

Vegetation of Illyria.—M. Marcel Hardy points out that it is now possible to form a precise idea of the physical features and vegetation of the countries which constitute Illyria in the extended sense. Taking the name to comprise the area between the Adriatic from the Gulf of Trieste to that of the Drin, the Save, and the Danube on the north, the Timok and the Morava on the east, and the Shar Dagh on the south, it is found that the region so defined constitutes a tectonic unity, despite the fact that it shows a great variety of relief, for it has all been subjected to the common action of the folding of the Dinaric Alps. The axis of the Alpine anticlinal of the region presents a vault of Palæozoic rocks, while as one passes away from this central axis calcareous formations of more and more recent origin are successively encountered. The calcareous beds of Cretaceous age constitute the Karst formation, which consists of very pure limestone, which is much fissured and hollowed out, and so forms an excessively dry substratum. The rocks descend towards the sea in lofty cliffs with intervening terraces, and occasional closed depressions or *polje*, which alone constitute the cultivable areas. At the other side of the coastal range occurs a system of high plateaux, separated by broad valleys, excavated in limestone of Triassic age, which is less pure and less permeable than the Cretaceous beds. Owing to the great variation of altitude, every variety of climate occurs within the area, and these variations determine the distribution of plants, which can be arranged in three series. On the littoral

climate and vegetation are Mediterranean in type. The summer is dry and hot, the winter mild and rainy; but though the annual rainfall varies from 700 to 1600 millimetres, yet, owing to the torrential character of the rains, the sky is nearly always clear. The two prevalent winds are the icy *bora*, which blows from the snow-capped mountains of the north-east, and is very destructive, and the hot and moist *sirocco*, which prevails during winter and blows from the south-west. The rains which this latter brings sweep the soil from the surface of the rocks, while the force with which it blows is often sufficient to uproot trees. The whole area now presents an aspect of desolation due to the squandering by man of its natural resources. Large tracts of land are absolutely sterile, and the general xerophytic type of the vegetation—the low-growing trees and bushes with persistent, coriaceous leaves, and the dried-looking herbage—give the district a very dreary aspect. As one ascends, however, to the region of the hills, the country becomes less desolate. Here deciduous trees are abundant: there are many species of oak, while ashes, and the black Austrian pine, also occur. Even where the forests have been destroyed leafy shrubs persist, and at worst the vegetation is less dried up than in the peripheral zone. The third zone is the Alpine or mountain region. Here magnificent forests occur. The beech is the dominant form, but it is accompanied by firs, pines, and other conifers, some of which form characteristic localised forests.—*La Géographie.*

Climate of Cyprus.—Mr. C. V. Bellamy contributes to the *Quarterly Journal of the Royal Meteorological Society* an interesting article on the climatic conditions in this island. He points out that the island is divided across the centre by the Central plains, which run east and west, and are known as the Messaoria on the east, the Nicosia in the centre, and the Morphou plain on the west. These plains have a length of about 60 miles, and are bounded on the north by the precipitous Kyrenia Mountains, while the southern and western portions of the island are occupied by the Troödos Mountains. The existence of these ranges has considerable influence on the climate of the plains, for they seem to moderate the cold of winter and to exclude what might be the cool sea-breezes of summer. There may be said to be only two seasons in Cyprus, for during about eight months the rainfall is scanty and uncertain. During the greater part of this time the plains are arid, and almost devoid of herbage, save for thistles, squills, and asphodel. After the first winter rain in October or November, the surface undergoes a rapid change, the cereal crops grow rapidly, and the land is soon clothed with verdure. Harvest-time is about May, and after the reaping of the crops, the earth rapidly assumes its barren aspect again. In the hill-country, the alternation of seasons is less marked, for here trees are abundant, except where the forests have been wantonly destroyed. Several species of pine are abundant, while plane, alder, sumac, oak, cypress, pistacia, walnut, olive, and locust-bean tree also grow freely. In certain parts of the island the vine is cultivated. In the mountain regions, perennial streams are numerous, and flow through fertile valleys, but they cease to flow at the surface when the plains are reached, and here streams only exist after rain. But this fact, though it gives the plains an appearance of great desolation, is really an advantage, for the water escapes surface evaporation, and can be obtained by digging in almost all parts of the island. It is apparently abundant everywhere at a depth of from thirty to sixty feet, and with proper management there seems no doubt that the land could be artificially irrigated, and made to bear crops all the year round.

For convenience of record, the author divides the year into two periods of six months, beginning respectively on April 1 (summer) and October 1 (winter).

The coldest month is January, while July and August are the hottest. The mean annual temperature is 67·2°, and the maximum recorded in the two years and a half of observation was 108°, the minimum 28°, showing the very remarkable range of 80°, which is probably quite exceptional. During 1899-1900 the total rainfall during the winter six months was 12·41 inches, during the summer six months 2·26 inches. As to winds, the most generally prevalent is that from the north-west, while north and south are the quarters from which it blows least frequently. In May there usually occurs the hot, dry Siroc, which blows from the eastern quadrant, and is the harbinger of summer.

Possible Existence of Coal in Meurthe-et-Moselle.—Professor R. Nicklès of Nancy sums up the results of his investigation of this problem as follows :—After two years' research, it cannot be said that the prospects of finding coal are particularly encouraging, and, if found, it may be too deep for profitable working. At the same time, there is a reasonable possibility that a profitable seam may be found, and the three following localities may be mentioned as least unfavourable for the attempt. First, in the region of Pont-à-Mousson, in the anticlinal of Eply-Atton and its prolongation. Second, in the region of Lunéville, in the arch of Mont-sur Meurthe-Blainville ; and third, in the region of Nancy, in the arch of Cercueil-Voirincourt, where the coal can only be expected at considerable depth. —*Revue Générale des Sciences*, February 28.

The Island of Gremsö.—In *La Géographie* for February 15 an abstract is given of a paper by Professor Thoroddsen on this little island, which lies on the northern coast of Iceland, and is very inaccessible. It is 5 kilometres long and 2 broad, and is composed entirely of basalt. The cliffs fall steeply down to the sea, especially on the eastern side, where the escarpments attain a height of 110 metres. Owing to the force of the winds the vegetation is very scanty, and much more Arctic in type than that of Iceland. But the climate, despite the frequency of icebergs in the vicinity, is relatively mild. The mean annual temperature is about 1·5 , but there is great variation, dependent on the presence or absence of icebergs. The highest temperature observed during twenty-one years was 26·2 in August, the lowest, - 30°, in January and March, but both these records are very exceptional, the average August temperature being 6·9 , and the average March record - 4 . Frost has been known to occur on 191 days, rain on 143 days, and snow on 56 days per annum. In 1890 the population consisted of 77 persons. The inhabitants subsist on the products of the fishery and of the capture of the birds which come to nest on the cliffs. Great numbers of fish are captured, and numerous eggs and adults of guillemots, Arctic petrels, gulls, and eggs of eider-ducks are obtained. In the absence of peat on the island, the inhabitants depend for fuel on driftwood, sheep dung, seaweed, and bones of fish. There are only two cows and two horses on the island, but a fair number of sheep. For several months in the winter all communication with Iceland is cut off, but in summer a steamer visits the island.

ASIA.

Signs of Glaciation in Japan.—Hitherto no one has ever found any trace of former glaciation in Japan, and it has been asserted that glaciers never existed in that country. Professor Yamazaki, of Tokyo, however, has, on *a priori* grounds, always been of the opinion that traces of former ice-action must exist somewhere in the country, and has recently found what he regards as definite evidence on the point. While making investigations in the Hida range, in the north-western mountains of the island, last summer, he found ice-grooves and striations on the

side of Shira-Umaga-Take, at a height of 2900 metres above sea-level. Similar signs could be made out further down the valley. It is a curious coincidence, if nothing more, that a few days later another Japanese scientist discovered a flora of Alpine type in the same locality.—*Science*, February 27.

AFRICA.

The Sudan-Abyssinian Frontier.—The map opposite indicates the frontier which was demarcated by the agreement of May 15, 1902, but was not made public till December last. The new boundary fixes the western frontier of Abyssinia only, the line to the south being still left undetermined. So far as actual territory goes, Abyssinia gains a little by the new frontier, but the treaty provides for certain concessions to the British Government.

The Semna Cataract of the Nile.—Dr. John Ball has made a survey of the Nile Valley at the rocks below Semna, with the object of studying the rapidity of river erosion there. Some sixty years ago, the explorer Lepsius discovered numerous inscriptions on the rocks at Semna which recorded the level of high Nile in various years during the 12th and 13th dynasties, that is some 4200 years ago. The difference between these levels and the average level of high Nile at present is approximately 24 feet. Hitherto no definite conclusions as to the cause of this difference have been come to by geologists, but Dr. Ball, as a result of his own observations, is of opinion that it is the result of the gradual wearing away of the barrier of gneiss which stretches across the Nile between the temples of Semna and Kumna, and is thus simply the effect of river erosion acting over the period named. Immediately above and below the temples the river has a width of about 1300 feet, but between them a narrow band of hard gneiss extends across the stream. At high Nile the river sweeps across the barrier without any perceptible diminution of width, but at low Nile the rocks are bare save for a narrow central channel of about 130 feet, in which runs the whole of the water. The portion of the barrier which is bare at low Nile is honeycombed with large potholes, which testify to the great eroding force of the flood-water, and here and there occur channels which, though analogous to the main channel, are filled only at high water. The existence of these affords strong presumptive evidence that the central channel owes its existence simply to river erosion, and has not been determined by any geological peculiarity of the region. The author gives some detailed measurements to show that the rate of erosion, as calculated from the inscriptions, is not excessive, but is in harmony with what is known as to the rate of river erosion elsewhere.—*Quarterly Journal of Geological Society.*

French Central African Expedition.—As briefly noticed in our last number p. 153, the Vicomte du Bourg de Bozas, the leader of this expedition, died on his way home. In *La Géographie* for February 15 some account is given of the journey of the expedition from Addis-Abbaba to the Nile by way of Lake Rudolf.

Two months were spent in the vicinity of Addis-Abbaba, and it was then quitted on March 1, 1902, with the object of joining the rest of the caravan at the Mountains of Arussi. The densely populated province of Gurage was crossed, and also the small district of Maroko, which forms a game preserve for the exclusive use of the Emperor Menelik. In Gurage the women are exceptionally good-looking, and agriculture is well advanced. The journey was continued through the poor district of Alaba, whence a detour was made to examine the Kambata region. In order to reach Sidamo, the desolate region of Cassa was then crossed, and found to be largely composed of marshes and quagmires, inhabited by lions,

NEW BOUNDARY BETWEEN ABYSSINIA AND EGYPTIAN SUDAN
ACCORDING TO TREATY OF MAY 1902

Suakin
Berber
Khartum
Kassala
Massaua
Hodeida
Mocha
Aden
Harar
Jauf
Sana
Meroe
Island
Tigre
ABYSSINIA
EGYPTIAN
SUDAN
Gondar
Matamma
Gedaref
Roseires
Dar Fazoki
Fashoda
Taufikia
Nasser
Lado
Amhara
Shoa
Gojam
Kaffa
Ankober
Addis Ababa
Adowa
Aussa
Obok
Zeila
Djibuti
FRENCH SOMALI LAND
BRITISH SOMALILAND
Harar
Dire Dawa
Jijiga
Berbera
Bulhar
Gulf of Aden
Bab el Mandeb
Red Sea
Dahlak
Farsan Is.
Hanish Is.
Kamaran I.
Hawakil B.
Massawa
Asmara
Keren
Agordat
Kassala
Gedaref
Roseires
Matamma
Gondar
Debra Tabor
Lake Tana
Adowa
Aksum
Adigrat
Makalle
Antalo
Ras Dashan
Hamasien
Senafe
Arkeqo
Hamilah
Hodeida
Mocha
Aden
Obok
Zeila
Djibuti
Harar
Jijiga
Dire Dawa
Addis Ababa
Ankober
Gojam
Kokstara
Shoa
Kaffa
Gore
Jimma
Bonga
Lake Rudolf
Basso Novo
Lake Stephanie
Basso Nachor
Lake Abaya
Lake Margherita
Lake Abbe
Lake Hanlo
Lake Logh
Lake Haik
Lake Dubbi
Lake Tsana
Lake Zwai
Lake Abassi
Lake Awasa
Lake Shala
Lake Abaya
Lake Margherita
Lake Rudolf
Lake Stephanie

leopards, and ostriches. The two lakes of Shalla and Abasi were then visited, and the whole caravan then travelled to Abera, the residence of the governor of Sidamo, placed in a prosperous and well-cultivated region. The party travelled thence towards Lake Abaya, crossing on their way the Guidabo, one of its affluents. The other important affluent is the Bilate, while the lake is drained to the south by the Sagan. The lake lies at a height of 1370 metres, and seems to be very shallow. Its margin is fringed by rushes, Papilionaceous plants, and arborescent members of the Malvaceæ; to these succeed mimosas. In the vicinity occur some thermal springs. Leaving Lake Abaya the party crossed the Bilate and ascended to a plateau of about 2000 metres in height, which lies in the middle of the Walamo country. The country here is undulating, surrounded by high mountains, well cultivated, and feeds considerable flocks of oxen and horses. The people are more civilised than their neighbours, and have some idea of commerce.

Thence the expedition directed its steps towards the south and west, reaching and crossing the river Maze, which is an affluent of the Omo. The Maze was found to be in flood, and running with great rapidity. Here the explorers arrived at a very mountainous region, where a number of mountain chains run parallel to one another, and where exist six little kingdoms, all paying tribute to the Abyssinians. Quitting the Abyssinian plateau the party then descended to the vast plain which stretches to Lake Rudolf, and followed the Ousna till its junction with the Omo, which river was followed down to Lake Rudolf. It was found that the northern shores of this lake show a regression of the water, but there is some evidence that this occurs periodically, and is a result of the dry season. After exploring the northern shores of the lake the journey was continued westward, in order to explore the Turkana country. As it was the dry season the country first crossed was devoid of habitations, and practically desert, but there was abundant evidence that it is well populated at other seasons of the year. The Turkana are warriors, nomads, and shepherds, though those near the shores of Lake Rudolf are likewise agriculturists. They have no social organisation, the unit being the family, or an association of families.

Leaving the Turkana country a desert tract was crossed, and then the watershed between Lake Rudolf and the Nile was ascended. This consists of a plateau of 1610 metres in height, which was found to be fertile and abounding in game. The journey being continued parallel to the mountains of Karamoyo, the party arrived at the foot of Mount Torror, in the vicinity of which the tribe of the Igiai was discovered, and later the small tribe of the Utumur. Thence the journey was continued to the Nile, which was reached at the British post of Nimule.

The course of this journey can be followed on the map of the Abyssinian boundary, which we publish this month.

Port for the Transvaal.—The Natal Government has been making preliminary surveys with a view to ascertaining whether the coast of Zululand offers any possible site for a harbour, which would connect with a railway line which might convey the produce of the Rand direct to the sea through all-British territory. Two possibilities at once present themselves, the Bay or Lake of St. Lucia and the Umhlatusi Lagoon. A rough survey of the first-named shows that both it and the tidal lagoon which connects it with the sea are quite unsuitable for the purpose. The lake is some 46 miles long by 11½ miles wide, and is now separated from the sea by a narrow range of sandhills, communicating with the tidal lagoon by a channel about 13 miles in length. The lake is shallow and contains brackish water; the surrounding country is low, marshy, and malarious, and fresh water and building stone are not readily accessible. On the other hand, coal seams crop up

in the neighbourhood. As regards the lagoon, there is not a sufficient volume of tidal water to maintain a navigable channel for vessels of moderate draught, and the basin seems in process of silting up through the débris brought down by the Umvolosi river when in flood. It is, however, otherwise with the Umhlatusi Lagoon. Its mouth is situated 36 miles to the south of the St. Lucia river, and about 44 miles north of the Tugela. It was thoroughly examined by the Government surveyor, and he came to the conclusion that at the cost of a little over a million sterling a harbour might be formed, with outer arms or breakwaters, training banks, and a thousand feet of wharfage. There will be no great difficulty in forming a channel of a depth of 15 feet at low water, and the difficulties connected with the dredging operations will not be greater, if as great, as they were at Durban. After a new channel has been cut, the area of the lagoon will be increased to probably not less than 10,228 acres, or more than twice the high-water area of Durban Bay. A further comparison of the two lagoons shows that there are about 3830 cubic yards of bank above low-water level per acre in the case of Durban, while in the Umhlatusi there are only about 450 cubic yards. A fine healthy site has been found for a township on the high land of the Bluff, on a stretch of grassy veldt gently sloping towards the Umzingazi lake and river, open to the breezes from the sea, and protected by higher and wooded sand dunes from the more violent gales that blow from the south-west and south-east. There is an abundant supply of fresh water near at hand ; and altogether the conditions of the ground seem to point to it as one that bears promise of being some day the port of Zululand, and a new outlet for the wealth and traffic of the Rand. A railway from Umhlatusi would open up Zululand and the new territories, and joining the main line somewhere about Volksrust, would form the shortest and best route to the Rand, a route which would easily outrival all others, and which would attract to a British port much of the capital which is in danger of being diverted to Delagoa Bay.

Uniform Time for South Africa.—Lord Milner has been in communication with the several States of South Africa with a view to the adoption of a common time throughout the colonies for railway and other public purposes. Hitherto there have been three different systems of calculating the time. The Governments of Cape Colony, Natal, the Transvaal, the Orange River Colony, and Rhodesia have agreed to adopt a uniform time based on the meridian of 30 degrees, or two hours east of Greenwich. The change came into operation at the beginning of March. It is expected that the local communities in each colony will speedily fall in with the new arrangement ; in many cases they have for some years urged the necessity of a standard time.

AMERICA.

Alluvial Lands of Colorado River. The hydrographic branch of the United States Geological Survey finds that between Camp Mohave and Yuma there are between 400,000 and 500,000 acres of alluvial bottom land. The average rainfall at Camp Mohave is only 5·99 inches per annum, and at Yuma only 3·06 inches per annum, while at both places the temperature is such as to provide twelve growing months in the year. The Colorado River derives its principal source of water-supply from the melting snow on the high mountains of Utah, Colorado, and Wyoming. It reaches the stage of maximum flow, approximately 50,000 cubic feet per second, in the months of May and June, when the demand for irrigation is normally highest, while its period of minimum flow occurs in the months of

January and February, when the irrigation demand is least. Further, the opportunities of storage of the river waters are very great, and it is found that the silt contained in the muddy water has great fertilising powers. In many ways the river resembles the Nile, and like it is subjected to periodical overflow. As it is better understood, and more fully utilised, there seems reason to hope that it will also compare favourably with the Nile in its usefulness to man.—*Science*, Feb. 27.

Fall of the Water Level in Great Salt Lake.—In the *National Geographic Magazine* for February, Mr. L. H. Murdoch draws attention to the recent diminution of the water contained in Great Salt Lake. At Garfield Beach, on December 1, 1902, the water gauge showed a fall of 11 feet 7 inches, as compared with the level in 1886, the date when the last rise in level ceased. This great fall is due to a combination of shortage in precipitation, and loss of water through irrigation, but the author is of opinion that it is the shortage in precipitation which is the predominating factor. During the last sixteen years the average rainfall in Utah has been below the normal, and this is especially true of the past three years, during which the deficiency has been estimated at 13 inches. But the records of rainfall since 1863 tend to show an alternation of wet and dry cycles in Salt Lake City. There is as yet no evidence as to the average duration of these cycles, but there is every reason to believe that the present dry cycle will be succeeded by a series of years in which the precipitation will be considerably above normal. The effect of such a wet cycle would probably be to raise the water of the lake nearly to its former high level, despite the increasing loss by irrigation.

The West Indian Eruptions.—In his discourse delivered at the Royal Institution on January 23, Dr. Tempest Anderson pointed out the remarkable similarity which exists between the islands of St. Vincent and Martinique. Both are roughly oval in form, with the long axis almost north and south. In each case a volcano lies in the north-western portion of the island, and the two volcanoes have many points in common. Both show a single, or practically single, vent, a remarkable absence of parasitic cones and a scarcity of dykes. In both cases there is a transverse valley to the south of the volcano, down which the greater part of the ejecta in the recent eruptions was in both cases discharged. The eruptions have been nearly synchronous, and have been characterised by the absence of lava, and of large bombs, and by the discharge of large amounts of incandescent ashes. The chief difference has been that the eruptions of the St. Vincent volcano were on a much larger scale than those of Mount Pelée. Further, the Soufrière shows no fumaroles, no hot springs, and no trace of radial cracks or fissures. In Mount Pelée there are many fumaroles, several hot springs, and a great fissure formerly extended down from the summit in the direction of the Rivière Blanche; these and other facts render it probable that there exist radial cracks entering deeply into the substance of the mountain.

It was the existence of the fissure at the top of the valley of the Rivière Blanche which led to the destruction of St. Pierre, for the valley acted as a funnel, down which the ejectamenta poured to the city. The fissure has now been filled up at its upper end, so that in subsequent eruptions, the material may be expected to spread over a wider area.

As to the exact cause of the eruptions, Dr. Anderson explains it as follows. In these, as in any other eruptions, a molten magma rises in the volcanic chimney, consisting of fusible silicates and other minerals, highly charged with water and other gases, and kept liquid by the enormous pressure. As the pressure diminishes with the rise of the material in the chimney, explosions take place, owing to the

expansion of the gases. In the case of the West Indian eruptions, the force of the explosions is just sufficient to blow the mass into atoms, and lift the greater part of it over the edge of the crater, without scattering it widely into the air. The mixture of solid particles and incandescent gases so produced behaves like a heavy liquid, and rolls down the mountain-side under the influence of gravity, forming the characteristic sand-blast. As it flows onward, the solid particles are gradually deposited, and the remaining gases are then free to ascend. The descending volume of fluid by compressing the air in front of it sets up a powerful blast, an effect already well known in the case of avalanches.

Flora of Orinoco Delta.—Dr. H. H. Rusby has recently explored this interesting region, whose flora has not apparently been previously studied. The delta extends about two hundred miles along the sea and about as far inland, if we include the region of rocky islands and deep rocky river channels in addition to the area of silt-deposits. The plants may be divided into four groups. There is first a hill flora which covers islands which are never submerged and the rocky banks of the river toward the interior. It is characterised by trees and bignoniaceous vines; Hog-Plum Spondias, Custard Apple (Anona), palms of the genus Bactris and many other trees, some very lofty, all occur. Second, there is a river flora, including a marginal flora on periodically submerged banks and a submerged flora upon islands. This chiefly consists of a mass of tangled vines, but includes some trees, such as an acacia (Inga), and a fig (Cecropia). Amongst the shrubs are included many with a milky juice, as Tabernoemontana, and many gorgeous blooming species of Solanum, while the herbs include a Spigelia, the source of a valuable drug. The third group of plants consists of those which inhabit the dense and terrible swamps formed by the overflow of the flood-water. On the surface of these swamps are found many floating and herbaceous aquatics, while many trees of the Rubiaceae family grow rooted in the mud. The swamps are quite impassable; it took Dr. Rusby three weeks to traverse nine miles of them, and he was then obliged to turn back without reaching his goal,—the Imataca mountains. The fourth group of plants forms the tidal flora, which extends some forty miles in breadth along the coast, where the villages are built on piles. The littoral flora at the ocean edge is soon replaced by an inland tidal flora, chiefly of stout fan-leaved palms of different species, from the short, spiny palms of the river-margins to the tall, smooth palms of the hills.—*Science.*

AUSTRALASIA.

Magnetic Work in New Zealand.—In *Nature* some account is given of the new observatory which has been erected at Christchurch, New Zealand, and of the magnetic work which is being carried on in that country by Dr. Farr. Prior to the establishment of this observatory only one magnetic observatory, that at Melbourne, existed in the whole of the Australasian region, a fact which greatly increases the importance of the new institution. During the stay of the *Discovery* at New Zealand the members of its magnetic staff had an opportunity of comparing their instruments with those at the Christchurch observatory, an opportunity of which they fully availed themselves, and there is no doubt that the Christchurch records should prove invaluable when it comes to dealing with the magnetic data of the Antarctic expeditions. Dr. Farr hopes in time to publish a complete magnetic survey of New Zealand, a work which he has already begun.

GENERAL.

German Geographical Congress.—We have received an intimation to the effect that the Fourteenth Meeting of the Deutschen Geographentag will be held at Cologne on the 2nd, 3rd, and 4th of June 1903.

All persons interested in the scientific study of Geography are invited to attend. They may join either as members or associates, and should make application to Herr Professor Dr. K. Hassert, General Secretary of the Local Committee, Bismarckstrasse 30, Cologne. The chief subjects of discussion will be as follows:—1. The present position of the German South Polar Expedition; 2. Oceanography; 3. Economic Geography; 4. The Geography of the Rhine Lands; 5. The Teaching of Geography. In addition to the discussions there will be geographical excursions to places of interest in the vicinity.

Formation of Pearls.—A curious illustration of the connection between economic geography and what may seem to be mere details of technical zoology is given by Dr. Lyster Jameson's investigations on the formation of pearls in mussels (*Proc. Zool. Soc.* 1902). He finds that the stimulus necessary for the production of pearls is given by the entrance into the mussel of a Trematode, or parasitic worm. This parasite, like all its allies, has a very complicated life-history, which has three distinct stages. The adult apparently occurs in the Eider Duck (*Somateria mollissima*), and in the Scoter or Black Duck (*Oedemia nigra*). From the bodies of these birds the eggs pass out into the water, and there, either they or the larvæ to which they give rise, enter the Carpet-shell (*Tapes*), or the common Cockle. Within this second host the larvæ reproduce and give rise to secondary larvæ, which leave the body of the host and reaching the water may infect mussels in which they give rise to pearls. The ducks are again infected by eating infected mussels. The practical corollary is that no scheme for the fostering of the pearl industry can hope for success unless it take account of the whole conditions, which probably in all cases involve a similar chain of organisms. For example, any scheme which was oblivious of the necessary association between carpet-shell and mussel is in the case of mussel pearls foredoomed to failure.

COMMERCIAL GEOGRAPHY.

The Commerce of Marocco.—M. Augustin Bernard gives in the *Revue Générale des Sciences* a very full account of the present condition of trade in Marocco, under the two heads of internal and external. The internal trade is still carried on under very primitive conditions. The interchange of commodities chiefly takes place at the periodical markets, which are held in rotation at certain convenient localities. To these the traders come armed, and they are the scene of frequent quarrels, and often of popular outbreaks. In the south of Marocco, these frequent markets, which usually last for only a part of a day, are supplemented by yearly or half-yearly fairs, which last for several days, and are conducted under the ægis of the marabouts, to whom they constitute a source both of honour and profit. But the supreme difficulty in the carrying on of trade is the absence of any protection for property, and the great uncertainty and difficulty of transport. Roads and bridges are virtually non-existent, and even the natural trade-routes are often impassable owing to brigandage. This uncertainty, and the heavy blackmail which has often to be paid, makes the cost of transport very serious. The chief routes along which commerce takes place are those connecting the ports with the two capitals of Fez and Merrakech, and those which cross the High Atlas in order to put their slopes into communication. As

regards communication with the rest of the world, the author emphasises the number of tourists, especially British tourists, who now frequent Marocco as a probable important element in future developments. In addition there are a considerable number of Europeans of the adventurer type.

The external commerce is carried on partly through the open ports, and partly by means of the frontier of Algiers. Of the eight open ports only Tangier has any attempt at harbour works, and in most cases the anchorage is uncertain, and the process of embarking fraught with great difficulties. In consequence, not only is the total trade small in amount, but it is also fluctuating, and shows no signs of steady increase. The chief imports are sugar, cotton goods, tea, and candles; the chief exports—wool, goatskins, eggs, cattle, maize, pease and beans, almonds, and wax. Both as regards exports and imports Britain leads the way, her trade being approximately equal to that of all the other European powers put together, but the relative importance of British commerce is diminishing, as that of Germany and Belgium increases. The Germans are indeed making strenuous efforts to oust the British. As yet the commerce with Algiers is not of great importance, but efforts are being made to improve it.

Italian Mining.—The *Bollettino* for December reports the produce of Italian mines for 1901 to amount to 5,036,669 tons, that for the preceding year being 4,960,585 tons; there is, however, a slight decrease in value, being 85,060,002 lire in 1900 as against 84,694,888, the difference being explained by a fall in the price of zinc. Of the above amount sulphur represents 3,726,916 tons of the value of 43,819,718 lire; lead, silver, and zinc 179,714 tons, valued at 21,826,706 lire.

The produce of Sicily was 537,615 tons, obtained by treatment of 3,479,049 tons of sulphur ore of the value of 51,240,086 lire, being an advance over the year 1900 of 18,376 tons, value 2,727,586 lire.

NEW BOOKS.

EUROPE.

Der Hercynische Florenbezirk. By Dr. Oscar Drude. 5 photographs, 16 figures in the text, and 1 map. Leipzig: W. Engelmann, 1902. Pp. 671.

Outlying parts of Europe were dealt with in the first four volumes of the "Vegetation of the Earth" Series, namely, the Spanish Peninsula, the Carpathians, the Caucasus, and the Balkan Peninsula. The heaths of the North German Plain were described recently in the fifth volume. The present work is devoted to a part of Central Europe with a complex plant-distribution, and is appropriately undertaken by one of the editors of the series, Prof. Oscar Drude of Dresden, who probably better than any one knows the problems of the area. Drude recognises three chief centres of plant-distribution in the German high-plateau: Hercynia is the central of these; the eastern is the Sudetic highland, distinguished by Baltic, Carpathian, and Alpine plants; the western is the Rhine highland with plants from the Jura and the south-west. Hercynia is divided by Drude into fifteen domains, of which six are mountain, and include the Harz in the west, the Thuringian Forest and Fichtelgebirge in the middle, the Erzgebirge and Lausitz in the east, and the Bohemian Forest in the south. Round the mountains cluster groups of foothills in Hesse, South Hanover, Thuringia, and Saxony. The area has been worked by botanists since the sixteenth century, and

one recognises many well-known names in the thirty pages of historical sketch and bibliography.

Part II. deals with the chief features of the physiography and meteorology of Hercynia. The upward range of vegetation is interesting because it is distinctly lower in the north than in the south, as follows:— 1. Plains (0-150 metres): these are limited to the valleys of the Elbe and Saale in the north, because the south limit lies entirely above 300 metres. (2) Foothills (upper limit, 400 m. in Harz, 750 m. in Bohemian Forest): these occupy the greater part of Hercynia and include *a*) an upper zone with a vegetation which includes the lowest descending mountain species; *b*) a lower zone of vegetation related to that of warmer regions. (3) Mountains (upper limit 1000 m. in Harz, 1360 m. in Bohemian Forest): this zone lies entirely in the south, except the isolated summits of the Harz. Forests are the chief element, and a lower zone of beech and silver fir is distinguished from an upper zone where the spruce reaches its fullest development. (4) Lofty mountains from 1000 to 1140 m. in Harz, and 1360 to 1460 in Bohemian Forest; the lower part of this is a transition zone between the forest zone and the summit sub-alpine grass, heather, and dwarf-tree vegetation. The area is thus an important one in regard to the vegetation of the foothills and the lower mountains.

Prof. Drude is a leader in the recent developments in the study of plant societies, especially in the recognition of "Formationen"; his description of the characteristic plant-formations of Hercynia in Part III. (pp. 90-275) is therefore a standard for workers in this branch of plant-geography. Thirty-two formations are recognised, of which eleven have trees as dominant social forms. The tree-distribution is specially interesting, because Hercynia lies in the principal area for the beech, hornbeam, silver fir, sycamore, lime, and other familiar trees naturalised in Britain from Central Europe.

Part IV. is devoted to the plant-formations of the different botanical domains. Each domain—the Harz, Erzgebirge, Fichtelgebirge, etc.—is considered by itself, and includes an account of the orographical and geological features, in addition to the purely botanical details. Part V. is a comparative review of the Hercynian flora with the rest of Europe.

The book is the result of enormous labour and long experience in a part of Europe which, botanically, is by no means simple. The work is carried out in great detail, but this very detail rather obscures the broad general facts. There is an excessive use of symbols in the species-lists, and a great difficulty in ascertaining what these mean, since the explanations are scattered about in the text. The editors of this series have not yet appreciated the value of characteristic landscapes and vegetation maps as aids to readers, especially foreigners. In this book of 660 pages the illustrations are: thirteen landscape photographs, six small maps in the text, and one map bound in. The latter is useful for topography, but of little use as a vegetation map. Of the six text-maps, two are geological; the other four show in black and white the vegetation of small areas, a small proportion of the whole. The plates from photographs are faultless, and amply prove how useful a greater number would be.

Wayfarers in Italy. By KATHARINE HOOKER. London: George Newnes, 1902. 12*s.* 6*d. net.*

A gossipy account of an unconventional rambling trip through Italy by some American ladies. They seem to have been indefatigable sightseers, making the most of their time and the best of everything, not grumbling at the petty

annoyances of foreign travel. The illustrations from photographs are well chosen, and the book will repay perusal by any one planning a tour in Italy. For instance, the writer describes how to get over the difficulty of dining and yet seeing the sunset in Venice.

Das Sonnwendgebirge im Unterinnthal: ein Typus alpinen Gebirgsbaues. Von Dr. Franz Wähner. Erster Theil. Leipzig und Wien: Franz Deuticke, 1903. 4to. Pp. xii + 356. *Price* 35*s*.

The Sonnwend Mountains, a small group, but of much geological interest, are skirted on the south-east by the Inn valley, a few miles below Innsbruck. They have formed a favourite haunt of geologists since the beginning of last century, so that a somewhat extensive literature has gathered round them. But it is only since the author of the present work began to devote himself to the study of the mountain-group in question that the geological structure of the region has come to be understood. In the important monograph, of which Part I. is now before us, we shall doubtless have a complete description of the whole region. Judging from the contents of this part, we can well believe the author when he tells us that his researches have extended over a long course of years. It everywhere displays evidence of laborious investigation. No line of research that promised to throw light upon his subject has been neglected. He has not only carefully studied the palæontology of the rocks, but has employed his microscope to excellent purpose, so that he is able to give us an adequate account of the nature and origin of the strata, and to make quite clear their stratigraphical succession. We now learn that the apparent sequence of the strata which is laid bare in natural sections is frequently deceptive, and the result of folding. The strata are often doubled back and pushed over each other so that the same beds may be again and again repeated in one and the same mountain-slope. With admirable skill our author has unravelled all these intricate structures, and gives us a most instructive picture of mountain-building. Great pains have been taken with the illustrations, the majority of which are reproductions from photographs, and are among the very best of the kind we have seen. From these we obtain a far better conception of what is meant by mountain-structure than from the more or less diagrammatic and idealised sections which so frequently illustrate geological descriptions of the Alpine lands. Not that the author does without these, for even the best photographs sometimes require diagrammatic explanation. As a rule, however, the photographic illustrations of this book are rendered intelligible by the use of conventional signs, dotted lines, and colours, so that the geological structures become evident at a glance. They are so numerous, moreover, and taken from so many different points of view, that the architecture of each individual mountain described cannot be misunderstood—the tone-pictures, wherever necessary, being supplemented by carefully drawn sections. In the present part the author gives first a synopsis of the literature dealing with the Sonnwendgebirge. This is followed by a sketch of the stratigraphical succession of the rocks which enter into the formation of the group. These include the various members of the Triassic system, from the Werfen beds up to the Kössen beds, as well as the lower members of the overlying Jurassic system. We are next presented with an outline of the orographic features and the leading geological structures—the most characteristic of the latter being recumbent folds and thrust-planes, and the consequent repetition of outcrops. In the next section of his work the author deals with dislocation- or fault-breccias, which are a notable feature of the region. Some of these are crush-breccias—the rocks have simply

yielded to enormous pressure, have in short been shattered *in situ*. Others are of the nature of friction-breccias, caused by the movement of one rock-mass over another. The careful study of these breccias is of the greatest interest to geologists. Professor Wähner shows how the crushed rock-débris lies embedded in a matrix which now and again simulates the well-known fluxion-structure so characteristic of many eruptive rocks. The concluding portion of this valuable monograph is taken up with a detailed description of the Haiderjoch, the Rofan, and the Sonnwendjoch. When the work is completed we shall be in a better position to appreciate its value as a contribution to the study of mountain-structure. Meanwhile, we must thank the author for the admirable skill with which he has so far dealt with his subject, nor can we doubt that when the work is completed it will take rank with such classical essays as Heim's *Mechanismus der Gebirgsbildung*.

The Coal-fields of Scotland. By Robert W. Dron. London: Blackie and Son, 1902. 8vo.

The author tells us that the object of his work is to present a fairly comprehensive review of the coal resources of Scotland, and of the geological conditions under which the coal-seams and associated strata are found in the various districts. In our opinion, Mr. Dron has been upon the whole successful, and we feel sure his work will be most acceptable to mining men and all who are engaged in the practical work of developing our coal-fields. Geologists also will meet with much to interest them in his pages, although they will probably dissent from some of the theoretical and speculative views entertained by the author. It is not for them, however, that the work has been prepared, but for "practical men" who have to do with the actual work of exploitation. The text is illustrated by a series of geological maps, and by horizontal and vertical sections, which will enable the reader to understand the general structure of the several basins in which the coal-bearing strata are arranged. Besides giving a particular account of each individual coal-producing area, and discussing its proved and probable resources, the author in a concluding chapter considers the much-debated question of the duration of our coal-fields. His conclusions are not too optimistic, and are perhaps as near the truth as other estimates of the kind.

The Survey Atlas of England and Wales. A Series of 84 Plates of Maps and Plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. Edinburgh: John Bartholomew and Co., The Geographical Institute. Under the Patronage of the Royal Geographical Society. 1903.

The following extracts from the Preface with which Mr. J. G. Bartholomew submits the *Atlas* to the public fairly describe the scope of the work :—

"*The Survey Atlas of England and Wales* presents on a uniform scale the topography of the country at the present day—it gives a graphic summary of its physical, political, and economic features. It is the outcome of much labour in the various departments of geographical and statistical research, and this is now brought together for the first time in a general reference work. The value of such a work must be evident to every one who would know his country and understand its development.

" . . . The plan of the work has been long and carefully considered, and its execution has been in progress for more than ten years. The compilation, drawing, engraving, and printing have been done under my direction and supervision, and no trouble or expense has been spared in trying to attain the greatest accuracy, completeness, and clearness of delineation. The basis of the *Atlas* is the Ordnance Survey, reduced by permission to the uniform scale of half an inch to the mile, in sixty-seven section maps, on which every part of England and Wales is mapped in topographical detail. These section maps are coloured according to contour-lines, showing at a glance the height of land all over the country, and they portray the physical features which more or less determine its social and industrial development.

" . . . The general maps and text illustrating Geography, Geology, and Meteorology have been submitted to the revision of Sir Archibald Geikie, F.R.S., Dr. Alexander Buchan, F.R.S., and other specialists. The Population, Agricultural, Industrial, and other statistical maps and text have been compiled from the 1901 census, and exhibit various interesting aspects of Demography. The various town plans have been revised by local surveyors.

" . . . I would gratefully acknowledge the Royal Geographical Society's recognition of the work as one of national importance and worthy of its patronage."

Mr. Bartholomew is given our hearty congratulations on the publication of the first part of the *Atlas* and on the early prospect of his long and patient labours being brought to a successful termination. The patronage of the Royal Geographical Society indicates the favour with which the scheme is regarded by that influential body, and the approval of the Director-General of the Ordnance Survey may be taken to imply that Mr. Bartholomew is accepted as a valuable coadjutor in the mapping work of the Government surveyors. It may be expected that the great convenience of these reduced sections, each of which takes in so much larger area than the one-inch maps of the Ordnance Survey, will soon be recognised by the public in England, as has been the case for Mr. Bartholomew's similar maps of Scotland.

As regards the technique of the published sections, which are of County Cumberland, where varied features of hill and vale have to be represented, the lining and lettering are clear and expressed in excellent taste, and the lithographic shading of the hills is very effective. For this shading a brighter tint of brown is used than for the *Atlas of Scotland*, but it forms a suitable contrast to the green colour which is adopted for the low lands in substitution for the light buff used in Scotland. When hills have to be shown on the sections, the green for the low lands has a pleasing effect along with the brown shading, but it is a question whether the strong colour may not be too obtrusive when in the flat counties the green colour may be required to cover the whole section.

Mr. Bartholomew has included with the list of maps which will appear in the completed *Atlas* twelve maps of his own compilation, as referred to in the preface, each dealing with a special scientific subject or branch of statistical information, and which will doubtless be much appreciated by those who seek the special information they afford.

The Alpujarra. By R. M. Thomas. London: Simpkin, Marshall, and Company. Carmarthen: W. Spurrell and Son.

The Alpujarra is that part of the Andalusian Highlands which lies between the Sierra Nevada and the Mediterranean, and is reputed to have been the scene

where the Moors made their last efforts to recover or maintain a footing in Spain. This little volume is the record of a tour through it last year, and may be commended as a chatty, pleasantly written account of rambles in a comparatively unknown region, where nothing exciting or remarkable happened; but the description of the discomforts undergone, the dirt and squalor of the so-called inns, the wretched roads, and the like, is not likely to induce any one to follow the author's example, even although the cost of living and travelling is exceptionally small.

ASIA.

Across Coveted Lands. By A. Henry Savage Landor. With 175 illustrations, diagrams, plans, and maps by the Author. Two volumes. Pp. 920. London: Macmillan and Co., 1902.

Travellers of the sixteenth and seventeenth centuries were often far too concise in their records of travel, those of the nineteenth and twentieth centuries are apt to be too prolix. The present volumes belong to the latter category, and would be more useful had their bulk been reduced. The route pursued was from Resht to Teheran, thence by Isfahan, Yezd, Kerman, Sher-i-Nasrya to Robat and along the new road between that place and Nushki to Quetta. The journey was performed first in a carriage, then on horseback, and finally on camels. Altitudes were taken at the stopping-places as well as at the foot and summit of the various passes and elevations traversed along the route. The photographs that accompany the text, though sometimes of little interest, are excellent.

Though Yezd is a town of some importance, there is no highroad between it and Isfahan. In spite of a great part of the town being in ruins and with a defective water-supply, it is described as a great trading-centre, while the inhabitants are, for Persians, very go-ahead and enterprising. There are about a dozen public schools where a good, relatively modern education is given. In quickness and intelligence Persian children put English children to shame, though these good qualities seem to have little effect on their after-life. The town of Kerman is fortunate in possessing an unusually good governor, who has lived long in Europe, speaks French well, and whose motto is, "When I want anything done well, I do it myself." No Europeans reside within the town, and there are only four in the vicinity, including the British Consul. The author's intention had been to cross the Salt Desert from here in a nearly easterly direction by Khabis and Neh to the Afghan frontier. But finding such a journey impossible in autumn he had to strike northwards by Lawah, and make a circuit by way of Birjand and Bandan to Sher-i-Nasrya. Lawah or Rawar, with a population of 10,000 inhabitants, is situated in an oasis, and is the last town before entering the desert. The people were unfriendly, suffer greatly from fever, and smoke opium in excess. In travelling, the nights though very bright were terribly cold, and caused a good deal of suffering to the caravan. At Naiband the author was badly received, was stoned, threatened, and insulted, but being a philosopher, did not take his reception in bad part. The natives were quite unlike the Persians of the west, and seemed to be of Beluch type. At Fedeshk, a stage further on, the natives were also fever-stricken, and smoke opium in over-large quantities. Birjand, with a population of about 30,000, stands next to Meshed in importance in the province of Khorassan. It is described as the commercial pivot of North-east Persia and West Afghanistan, where British and Russian competition in East Persia will eventually come into collision. Traders from India have already found their way thither and do a certain amount of business, though they cannot com-

pete with Russian cottons and tea. From Birjand the route now turned south-eastwards through a dreary country, where the road was lost several times, and robbers threatened the caravan, to Nazirabad, or Sher-i-Nasrya as it ought to be called, where a British Consul resides. From here the author made an excursion to visit the ruins of Zaidan, a town which is said to have stretched along a distance of eighty-six miles. The ruins are described in considerable detail. A visit was also made to the Kuh-i-Kwajah, which he found to be 900 feet high, whereas Major Sykes only placed the height at 400 feet. The Major says the mountain resembles "an apple," Mr. Savage Landor avers it is like "an inverted soup-plate." The probability is that both observers described the mountain from different points of view, so that both may be right; the difference of altitude is a more serious matter. At Robat the author struck the new British road between that place and Nushki, so that travelling became comparatively facile. On reaching Quetta he had traversed the Coveted Lands, and, judging from his description, on their own account they are not worth coveting.

The author is a man with a good many prejudices. He believes we impart to the natives of India some smattering of the semi-barbaric, obsolete ways we possess ourselves, but from his long experience of natives all over Asia it does not appear to him that what we teach really improves the Eastern peoples. He regards the Russians as our superiors in this respect. "The natives under his *régime* seem happy, and his work of civilisation is more of the patriarchal style, tending more to enrich the people, to promote commerce and trade on appropriate lines than to educate the masses according to Western methods and laws. The results are most decidedly good, and anyhow lead to much greater contentment among the masses than we can secure, for instance, in India." Mr. Landor, who has a grudge against Anglo-Indians generally, goes out of his way to attack Sir Thomas Holdich for the way in which he delimited the Perso-Beluch frontier. He doubts whether he visited the whole line of frontier; whether the astronomical positions of the principal points have been accurately tested, and insinuates that certain inaccuracies, though corrected by really efficient officers, have been allowed to remain, in order to cover certain discrepancies. He avers that the facts are too commonly known by all the officers in Beluchistan and by the Foreign Office in Calcutta, as well as by the Persians, to be kept a secret.

Vom Kaukasus zum Mittelmeer. By Paul Rohrbach. With 42 Illustrations. Pp. 224. Leipzig and Berlin: B. G. Teubner, 1903.

Armenia is not often visited save by those with a special object in view. In the present instance the chief purpose of the journey was to look for old Armenian MSS., though the author seems to be unacquainted with the language, either ancient or modern. Starting from Russia, he and his wife crossed the Caucasus to Tiflis, and then travelled southwards by Lake Sevang to Echmiadzin, Arjish, and across Lake Van to the town of Van. Their route then turned westwards by Bitlis, Mush, Palu, to Sivas, and finally southwards by Kaisarich, through the Cilician Gates, to Tarsus and Messina. The journey was made shortly after the Emperor William's visit to Constantinople, a circumstance that greatly facilitated their movements. As Germans, and therefore friends of the Sultan, they were everywhere very hospitably entertained by the Turkish officials, and were able to reach their destination in safety, without further annoyance than the inevitable discomfort associated with travelling in the Nearer East.

At Van, along the south shore of the lake, at Palu, and other places, the author was horrified at the desolation caused by the Kurds three years previously, and

cannot conceal his emotions at the criminal folly of the Porte in ordering a general massacre of a people from whom nearly the whole taxation of the provinces is derived. But he believes that the Sultan is now aware of the mistake he has made, and that the blood-bath will not be repeated. He traces back the massacres of 1895-96 to Article 61 of the Berlin Congress of 1878. After that event a new generation of Armenians sprang up, deeply imbued with the belief that the Great Powers had promised reforms, security from the Kurds, and—in case of non-compliance with these conditions—European intervention. As no reforms took place, and everything went on as before, the young Armenians became restive. The Sultan lost his head, and, as soon as he had made sure that Germany would not intervene, sent orders that the Armenians should be decimated. The author estimates the Armenian population in Armenia at not less than one and a quarter or one and a half millions, besides several hundred thousands in Constantinople and other parts of Turkey. About 200,000 were killed or died of hunger in 1895-96, and 50,000 crossed the frontier into Russian territory.

The last chapter gives the results of a trip, made two years later, through Mesopotamia, to visit the German Orient Missions at Urfa and Diarbekr. After the massacres, committees were formed in Germany to assist the Armenians. One set ran on orthodox, pietistic lines, the other on broader lines. The managers of the latter soon arrived at the conclusion that assistance must not be confined to Armenians, that proselytising was a mistake, and that the Mussulman population must be influenced. The title of these missions was therefore altered to "German Orient Mission," the word "Armenian" being deleted. In making this change of front the managers seem to have been partly influenced by political motives, for the author gives the following statement of his views:—"The more we are penetrated by the conviction that a large and important part of our national future lies in the Mohammedan lands of the East, the more we are bound to recognise that our moral right to this future is conditioned by the ratio in which we stand towards the East in the matter of give and take." The mission at Urfa has started a large carpet factory, which gives work to several hundred Armenians, and includes a well-fitted-up hospital. It is hoped that this will inspire both Christians and Mussulmans with respect for the German name.

Should Mesopotamia flourish again, the author believes Urfa will become a great natural centre of trade. The production of wool should be encouraged as much as possible, as there is pasturage in North Mesopotamia for millions of sheep. It would be a great advantage for the German textile industry to obtain its wool from there instead of from Australia and the Cape.

The Travels of Pedro Teixeira, with his Kings of Hormuz, and Extracts from his Kings of Persia. Translated and Annotated by William F. Sinclair, Bombay Civil Service (Retired), with further Notes and an Introduction by Donald Ferguson. London: Printed for the Hakluyt Society, 1902.

Towards the end of the sixteenth century the spirit of maritime adventure and geographical exploration had become powerfully developed among the Dutch, Portuguese, and Spanish, as well as the English, and the glamour of Cathay or the Far East had lost none of its attraction. Thanks to the Hakluyt Society, whose invaluable services to history, geography, archæology, etc., are well known and universally acknowledged, we have in the volume now before us a new and interesting narrative of the adventures and observations of one Pedro Teixeira, which, so far as we are aware, have not hitherto been available in English to the general public, except in the antiquated and often faulty translation of Captain

John Stevens. Of Teixeira himself but little is known. His birthplace, parentage, and training are never referred to in his works, and even his profession is left to conjecture. Mr. Sinclair was of opinion that he was "a physician—rather an 'irregular practitioner' probably, and concerned in the drug trade, and probably a speculator in gems," and in this opinion Mr. Ferguson concurs. In fact, practically nothing is known about Teixeira till he appears at Goa in 1587, but it is reasonably conjectured that he was on board one of the vessels under Jeronymo Continho which left Lisbon for Goa in 1586. He had not been long at Goa when he volunteered to accompany a fleet of ships which had been commissioned to proceed to Hormuz, to revenge insults and injuries inflicted by the Turks on the Portuguese in the Red Sea and Persian Gulf. The expedition was successful, but unfortunately its leader, Martin Affonso di Mello, died ere it could return to Goa, which it did in October 1587. Some six months after this we find the adventurous Teixeira again volunteering to join a punitive expedition to Colombo, in Ceylon, under the command of De Sousa Continho, and after again spending some months in Goa, he joined another expedition against the Turks on the eastern coast of Africa. Mr. Ferguson thinks that Teixeira spent the year 1592 somewhere on the west coast of India, and that in 1593 he went to Hormuz, where he lived till 1597, studying the Persian language and history, and translating the Chronicles of Mir Khwand and Turan Shah. From Hormuz he visited Mazandaron (Sari), and returned to Goa, whence he sailed for Malacca, where he spent two and a half years. In May 1600 he left Malacca on his homeward journey to Lisbon, and in the volume now before us we have his "Narrative of my Journey from India to Italy." His route was *viâ* Borneo and New Spain. He disembarked at Acapulco, whence he proceeded to the city of Mexico, where he stayed some four months, and then he marched to Vera Cruz, where he set sail for Spain on the last day of May. What with bad storms and worse dangers from corsairs and English buccaneers, Teixeira's voyage must have been an exciting one, and he was doubtless very glad to reach Seville in September 1601. Pecuniary troubles drove him to return to Goa in 1603, and after a brief stay of four months he started on his homeward journey, this time *viâ* the Euphrates Valley. Leaving Goa in February 1604, he sailed for the Persian Gulf, and after some exciting incidents, reached Hormuz in the middle of March. After a stay of a month there, he made sail for Basra, which he did not reach till August owing to storms and head winds. At Basra he joined a caravan on its way to Aleppo, and on the route he passed Mashad Ali, Mashad Husain, Bagdad, and Ana, of each and all of which we have graphic and interesting descriptions. From Aleppo Teixeira made for Alexandretta, and thence took sail for Venice, where, after as usual encountering much stormy weather, he arrived in July 1605. He says he travelled a good deal in Italy, and then crossing the Alps he passed through France into the Netherlands to Antwerp, where he published his travels and his historical works. Opinions differ as to whether he died at Antwerp or at Verona.

This volume contains a translation of the journey from India to Italy, the history of the kings of Ormuz, and extracts from the history of the kings of Persia. We gather from the Introduction that Mr. Sinclair unfortunately died ere he had finished his translation of Teixeira, and it fell to Mr. Ferguson to complete the work. The interest and value of the work of course depend on Teixeira's qualifications and truthfulness as an observer, and on this point Mr. Sinclair says, "The view I take of Teixeira is that he was an excellent observer and eye-witness, and is still valuable in that character. I cannot attach much importance, at this day, to what he reports at second-hand, in spite of his own stout confidence in his informants. . . . I look upon him as an early, or the first,

'globe-trotter,' and value him chiefly in that capacity." The Introduction, from which much of the foregoing remarks have been taken, is by Mr. Ferguson, and contains an interesting paper on "the first coming of the English and the Dutch into the East." The volume is extremely interesting, and well up to the high standard of excellence by which all the publications of the Hakluyt Society are invariably measured.

A Naturalist in Indian Seas; or, Four Years with the Royal Indian Marine Survey Ship "Investigator." By A. Alcock, M.B., LL.D., F.R.S. London: John Murray, 1902.

This is a charming book, which may be cordially recommended to all those who possess any interest whatever in the sea and its inhabitants. It contains first of all an account of the dredging expeditions in which Dr. Alcock has taken part; second, a description of the deep-sea fauna of the Indian region; and finally, an appendix with full bibliographies of the *Investigator's* work, and lists of the dredging stations. Dr. Alcock states in his preface that it has been his object in the first two divisions of his book to make himself entirely plain to the general reader, and he has thoroughly succeeded in his purpose. The narrative itself is full of charm and fresh enthusiasm, and the earlier chapters, in which the author expounds the objects, methods, and chief results of modern deep-sea dredging, are admirable in their clearness and simplicity. Based, as the author points out, on parts of the *Challenger* results, they should reach an audience to which those great volumes are inaccessible.

The story of the voyages of the *Investigator* is full of interest, not only to naturalist and geographer, but also to the ethnologist. Perhaps the most delightful passage is the description of the little atoll of Minnikoy, in the Laccadive Sea. Here upon a strip of coral sand, about six miles long and half a mile in breadth, live some 4000 people, in what seems to be a state of idyllic bliss. Here is no wealth; no poverty, no policeman; no prison, the inhabitants are healthy, clean, and happy. In this "happy isle" we are told that in all the affairs of life, save those of fishing and navigation, the women "exercise a paramount influence"—but far be it from us to draw any deductions from this strange fact. Dr. Alcock admits that further investigation might show that even in Minnikoy the dread serpent lurks, but the list of possible sorrows which he gives is but a short one. Here, as elsewhere in these seas, there is the risk of a storm wave sweeping over the little islet, raised but a few feet above the sea-level; hurricanes may destroy the island capital of boats and cocoanut palms: more chronic are the plagues of rats and mosquitoes, the former of which work great havoc in the plantations; leprosy also occurs, but the lepers were not numerous, and were carefully segregated from the healthy members of the community. All the inhabitants have their special work, that of the women being the making of rope from the husk of the cocoanuts; but for a full description of this simple, unspecialised commonwealth, we must refer our readers to the volume itself. With the description of happy Minnikoy may be contrasted that of the uninhabited Pitti Island. Here the bare sand was strewn with young terns, hatched from eggs laid on the sand, without any trace of nest. These were being preyed upon by hosts of large hermit-crabs (*Coenobita*), who were tearing them limb from limb—so that even in the Laccadive Seas Nature can still be cruel.

The naturalist who has been obliged to confine his dredging operations to our seas will be filled with jealousy at the *Investigator's* wonderful hauls; but this feeling will soon be assuaged as he perceives what admirable use Dr. Alcock has made of his opportunities, and the extent to which he has enriched science by

his observations. More than this, he has set forth his results in such a way that they will infallibly lead others to go and do likewise, or at least attempt to do so, and this, we are sure, is an end dear to the author's heart.

Mon Tour du Monde. Par la Comtesse du Bourg de Bozas. Paris: Librairie Plon, Plon-Nourrit et Cie, Imprimeurs-Éditeurs, 8 Rue Garancière, 1903.

We have all heard of the globe-trotter whose single idea is to hurry through as many places as possible, and who considers ten minutes quite a sufficient allowance of time in which to see St. Mark's in Venice, or the view from Zermatt, or the Taj at Agra; and we fear that Madame la Comtesse du Bourg de Bozas must be put down as not far removed from that class of traveller. She arrived at Bombay on the 11th January, and before she left Colombo for China on the 17th March she had visited Baroda, Mhow, Ahmedabad, Jaipur, Delhi, Kapurthala, Amritsar, Lahore, Agra, Gwalior, Benares, Calcutta, and Darjeeling. From Colombo she proceeded to Penang, Singapore, Hongkong, Shanghai, and Japan, reaching Vancouver on the 23rd April. In three and a half months she had "done" Asia, but with becoming modesty in her introduction she disclaims "les graves dissertations économiques, les aperçus profonds sur la politique étrangère, les démonstrations scientifiques"; on the other hand, it appears that "ce livre s'adresse à ceux qui, dans les récits de voyage, cherchent surtout la note vraie et, comme disait Guy de Maupassant, 'l'humble vérité.'" After this we are not surprised to find on page 37 a photograph of "Un Brahmane se rendant aux Tours de Silence!" or at page 50 that the Indian army consists of 650,000 men, exclusive of the armies of the native states, or at page 52 that in the officers' quarters at Mhow there is a nightly concert not only of the howlings of jackals, but also of the hissing of cobras in pursuit of their prey. The greater part of the book is a description of sightseeing, but this did not monopolise the Countess's attention; she went in for sport, and her description of pig-sticking at Kapurthala may be given as another example of course of "l'humble vérité." "Les chasseurs montent des chevaux dressés, et sont armés chacun d'une lance longue de six à huit pieds, munie d'une pointe en acier; des shikaris rabattent les sangliers, qui, ne trouvant pas d'issue, chargent les chasseurs. Toute la tactique du cavalier consiste à faire pivoter son cheval de manière à parer d'un coup de lance l'assaut de l'animal. L'arme reste dans la chair comme une banderelle dans le garrot du taureau. Après avoir été atteint plusieurs fois, le sanglier s'abat couvert de sang. Le cavalier se comporte en résumé comme le picador espagnol qui évite la charge du taureau aux applaudissements des *afreconados*. . . . Les Hindous sont plus audacieux encore que les Européens; on en a vu qui, rejoignant au galop un sanglier, lui tranchaient la tête au passage, d'un seul coup de *tarwar*." As was to be expected, the Countess is good at describing costumes, and she is equally successful in describing horrors, such as those of the famine and the plague in India, or of the instruments of torture which were so liberally displayed to her at Canton. Calcutta society will hear with astonishment that "les clubs de Calcutta reçoivent-ils seulement les Anglais qui relèvent du gouvernement, les fonctionnaires n'entretenant avec leurs compatriotes commerçants ou industriels que des relations peu amicales," and Calcutta ladies will sink in confusion as the Countess after a scathing remark about "misses aux toilettes *criardes*" continues with "La grâce n'est pas le propre des Anglaises de Calcutta; c'est en vain que l'on cherche dans cette foule une note d'élégance véritable." But we have said enough to show that the unconscious nonsense of the Countess will afford much amusement to those who know the East.

On the Coasts of Cathay and Cipango Forty Years Ago. By Wm. Blakeney, R.N. London: E. Stock, 1902. Pp. 353.

Few books of its size contain so many useful charts and illustrations as this narrative of one of the surveying officers on board H.M. sailing frigate *Actæon* from 1856 to 1862. The *Actæon* took part in the bombardment of Canton on 28th December 1857, and her captain was killed in the assault. The author concludes by prophesying that "though Russia is the most grasping empire the world has known, the mastery of the Pacific will not rest with her. Her seaboard will be controlled by that mighty breakwater, the foundations of which are already laid—the possessions of England in the Malay Peninsula and Borneo, those of the United States in the Philippines, of Japan in Formosa and the islands stretching thence to Great Japan herself. Russia, I venture to predict, is likely to be driven out of Sakhalin." Incidentally he mentions that Port Arthur (now in Russian hands) derived its name from the commander of the British gunboat *Algerine*, which was the first foreign warship to enter this now celebrated port. A photograph of Captain W. Arthur is given.

AFRICA.

South Africa and its Future. Edited by Louis Creswicke, author of *South Africa and the Transvaal War.* London and Edinburgh: T. C. and E. C. Jack.

The particoloured exterior of this otherwise handsome volume may be taken as symbolical of its no less varied contents. These consist of a series of papers on special aspects of South Africa, written with the view of forecasting its future. The contents are only incidentally geographical, this feature being best represented in the articles on Agriculture, Wool-growing, Railways, and Health Resorts. The place of honour is given to the Duke of Argyll, who considers the question of Emigration, and points out, as do other contributors, the desirability and even the necessity of some well-organised scheme of supplying South Africa with that which it most requires—British settlers to occupy the land. Next in importance, but a necessary accompaniment of the other, as we learn from other writers, is a large and carefully planned scheme of irrigation, which would throw a greatly increased area of good land into the sphere of possible cultivation. A third desideratum is an extended and much cheapened railway service. The facts given on this point are startling, and the comparison made with the Canadian-Pacific Railway, whose rates are only one-tenth of those charged in parts of South Africa, is very suggestive. The analysis of the types of climate and other considerations affecting the development of health resorts in South Africa is an excellent part of the volume. A good commercial map of the colonies, with insets showing temperature, rainfall, and vegetation respectively, together with a number of illustrations, including sketch-maps of the gold-fields and the railway systems, add to the value of this compendium of information.

Cape Colony for the Settler. By A. R. E. Burton, F.R.G.S. London: P. S. King and Son. South Africa: J. C. Juta and Co., 1903.

The writer is the Editor of the *Transvaal Agricultural Magazine*, and the volume itself is issued by order of the Government of Cape Colony. It should be useful to the prospective settler. The author deals first with special subjects, native labour, irrigation, etc., giving attention in particular to viticulture.

He then gives a "statistical account" of each division of the Colony, using the latest official returns. The illustrations are mostly good, and the coloured maps giving the local distribution of rainfall, horned cattle, etc., are excellent. It has to be kept in mind that unlike other parts of the Colony the maximum rainfall of the West Province occurs in winter, and hence the importance of the grape-growing industry in that part.

AMERICA.

Mont Pelée and the Tragedy of Martinique. By Angelo Heilprin. Philadelphia and London: J. B. Lippincott and Co. *Price* 15*s.*

The writer is President of the Geographical Society of Philadelphia, U.S.A., was formerly Professor of Geology there, and is well equipped for a comparative study of this great eruption. He is also well equipped in respect of local observation, and his hardihood on more than one occasion was nearly attended with fatal results. The story of the great disaster of last May is well told—the continuous warnings, the great mud-flow of the 5th, which traversed three miles in three minutes, the awful "tornadic blast" of the 8th, which in an instant overwhelmed St. Pierre and its 30,000 inhabitants, and the more widespread but less destructive explosion on the 20th. The phenomena of the eruption are dealt with in detail, and among much that is still doubtful, the author is able to give a clear opinion, agreeing in this with British scientists, that the mighty cloud which fell on St. Pierre, instantaneously scorching everything in its path and setting fire to the town, was mainly composed of superheated steam. An interesting chapter deals with the parallel between the destruction of St. Pierre and that of Pompeii and Herculaneum in A.D. 79. Mr. Heilprin considers that there is evidence in the traces of the earlier disaster of a similar discharge of superheated steam, and in this view the story of the Roman sentry found dead at his post assumes a new aspect. Among all modern eruptions that of Mont Pelée seems to have been unique in its magnetic effects, the disturbance being acutely felt half way round the globe. Mr. Heilprin devotes a chapter to the Soufrière disaster on St. Vincent (which was due to a much vaster explosion than the other), but he did not land on the island. Though heavy in the hand, the book is most readable, and is finely illustrated.

AUSTRALASIA.

In the Isles of the Sea. By Francis Awdry. London and Derby: Bemrose and Sons, Limited, 1902.

The Isles of the Sea which are the subject of this book are Melanesia, or the various groups of semi-savage islands which lie to the north-east between Australia and New Guinea. Little was known of them up to the year 1848, when the first Bishop Selwyn, then Bishop of New Zealand, sailed in H.M.S. *Dido* and first inspected a few of the islands, which had then a gruesome reputation as the abode of cannibals and head-hunters. In the volume now before us we have an enthusiastic, but at the same time honest, account of the rise and spread of Christianity in places which might fairly be called the darkest of the earth. The story is very pleasant reading, and is a just and welcome tribute to the devotion and self-sacrifice of brave missionaries, both native and English, many of whom lost their lives in the arduous and too often discouraging task of assaulting the strongholds of superstition and savagery. The writer is not new to the work of describing these islands, and incidentally she has much interesting information to give us about the habits and customs of the people.

GENERAL.

Stanford's Compendium of Geography and Travel. (New Issue). *Europe.* Vol. ii. *The North-West.* By George G. Chisholm, M.A., B.Sc. Edin. London: Edward Stanford, 1902. *Price* 15*s.*

With the volume now before us we understand that the new issue of *Stanford's Compendium of Geography and Travel* is completed. The first volume dealing with Europe was published in 1899, and it is unnecessary to point out the disadvantages incidental to a publication of the second volume after a lapse of more than three years. On the other hand, the delay in publication has not been an unalloyed evil. The greater part of this volume is devoted to the British islands, and thus the writer has been able to utilise the statistics of the last census and so to bring his figures up to date. The work is valuable as showing with reference to North-Western Europia, *i.e* Belgium and the Netherlands, the British Islands, Scandinavia, and Denmark, "how geographical conditions have affected the course of history," and it is to be noted that the term "history" is here used in a very wide sense. No pains have been spared to produce a thoughtful, suggestive, and accurate compendium of information regarding the history, geography, and economic conditions of the countries named above, and Mr. Chisholm was fortunate in being able to secure the assistance of such able coadjutors as Mr. J. T. Bealby, Mr. T. W. Arnold, Professor Geikie, and others. The book is equipped with many useful maps and excellent illustrations. We have a sincere pleasure in congratulating the publishers on the completion of a series of works so important and valuable to every student of geography, history, and economics.

The Administration of Dependencies, a Study of the Evolution of the Federal Empire, with special reference to American Colonial Problems. By Alpheus H. Snow. New York and London: G. P. Putnam's Sons, 1902. Pp. vi + 619. *Price* 15*s. net.*

This book has its origin in the newly-gotten possession by the United States of America of Hawaii, Porto Rico, and the Philippine Islands. For although primarily entitled *The Administration of Dependencies*, it is not a general historical treatise at all, but an American book with a purely American purpose. It is a solid and solemn production. No grace of style lightens its weight; no rays of wit or humour cheer the reader as he trudges over its dreary paragraphs. It in large part consists of lengthy extracts from old ordinances, resolutions, and controversial and other writings public and private. These were of supreme interest to those who wrote and who first read them, and they doubtless are of great value to the dryasdust historical craftsman. But they soon weary the student of history who is content with the essence distilled from such materials by the expert, and this book is probably not destined to gain many readers.

Article iv. Section iii. § 1 of the constitution of the United States laid down that new States might be admitted into the Union by the Congress; and Article iv. Section iii. § 2 that the Congress had power to dispose of, and make all needful rules and regulations respecting, the territory or other property belonging to the United States. The territory before the minds of the framers of the constitution were the tracts lying outside the definite western boundaries of certain of the States forming the Union, and already or soon about to be occupied by settlers of European descent. In view of the prospect and intention that these tracts might—as they actually did—become in time States of the Union, no serious question of principle as to their initial administration was imminent or ever did

arise. But in these latter days, through conquest and cession from a despotic alien Power, territories with settled and not wholly uncivilised inhabitants have come under the sway of the United States, regarding which the suggestion that they ever can or will be admitted as States into the Union seems, if conceivable, little likely of fulfilment. The subject territories now "belong to" the United States. How then is domination over them to be explained in the light of the principles for which the Americans of the Revolution fought, and in the name of which the bird of freedom has spread out his wings and raised his shrill cry for more than a hundred years? how justify the levying of dues and taxes from populations that have not, and never will have, votes? how vindicate the imposition of ordinances, and the stationing of battalions and battleships to enforce them, upon peoples who have no voice, and never will have one, in the councils of the Power to which they are subject?

The practical politician will not trouble himself about the past. He knows that the sentiment of the workaday American quickly evaporates when "the present gain" begins to play upon it, and that before long domination over subject peoples, if it prove not unprofitable, will not trouble his conscience. But meanwhile there are timorous and scrupulous souls to be fortified and absolved. To such the author of this book addresses his explanation of the present position. It is, that on the basis of principles deposited in the minds of the revolutionary leaders, the American Union and the lands and peoples of its dependencies constitute a Federal Empire within which the Union is under contract with the dependencies to treat them as a just and generous trustee ought to do. "The Federal Empire," he says, "is the outgrowth of democratic and republican principles. The Imperial State recognises itself as under a trusteeship toward every part of the whole Empire, and hence as the delegate and representative of the dependencies as political persons or States. Where Imperial States base their actions upon these principles, dependencies which are abundantly strong enough to become independent prefer not to do so, and weak dependencies regard the relationship as one in which they can take pride and satisfaction. Such a consent is equivalent to an election of the Imperial State, by the dependencies, to be their Central Government. Thus the republican principle of representation—that all governors, whether persons or States, are the agents or trustees of the governed—is preserved. The democratic principle is preserved because the whole conception of a State acting through its representative Government as the Central Government of its related political communities is impossible unless the Imperial State is founded on democratic principles; and because all power of the Imperial State is regarded as emanating from a grant made by all the people of the Empire" (p. 602).

This is the conclusion, in establishing which to his own satisfaction the author exhausts five hundred pages of quotation and argument. He may quiet some American scruples, or soothe some in that country who need persuasion that (to use his own words) there is "both a moral compulsion which compels the American Union to perform Imperial obligations when they come upon them in the ordinary course of events, and a pleasure in performing them well." But even the author can hardly have convinced himself that the Filipinos, after defeat and subjugation, will take pride and satisfaction in the knowledge that they have on democratic principles succeeded in electing the United States of America to be their Central Government—that those States are their delegate and representative in the American Federal Empire.

The most readable passages in the book are in its last chapter. In it, among other paragraphs containing matter of the sort just quoted, is a discussion as to the form which a Colonial Department of the United States Government should take,

and how the Department should be worked and controlled. It likewise contains some just and high-minded remarks upon the grave moral responsibility of the people of the American Union for the good administration of their new dependencies by means of picked and trained men, not as a monopoly for their own profit but on behalf of the subject peoples, and "for all the world." If this responsibility is recognised and truly acted upon, it matters little whether the process is an entirely new departure or, as this book would have us think, "the evolution of the unwritten constitution of the American Federal Empire."

ERRATUM.—At page 159 in our last number the publisher of Mr. W. Bisiker's *Across Iceland* was given as *Edwin* Arnold in place of *Edward* Arnold.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

With Macdonald in Uganda. A Narrative Account of the Uganda Mutiny and Macdonald Expedition in the Uganda Protectorate, and the Territories to the North. By Major H. H. Austin, C.M.G., D.S.O., R.E. Pp. xv + 314. Demy 8vo. With map and illustrations. *Price* 15*s. net.* London: Edward Arnold, 1903.

In the Andamans and Nicobars. The Narrative of a Cruise in the Schooner *Terrapin*, with Notices of the Islands, their Fauna, Ethnology, etc. By C. Boden Kloss. Pp. xvi + 373. Medium 8vo. *Price* 21*s. net.* London: John Murray, 1903.

Mountaineering in the Sierra Nevada. By Clarence King. Pp. xiii + 379. Crown 8vo. *Price* 6*s. net.* London: T. Fisher Unwin, 1903.

Journal of a Tour in the Highlands and Western Islands of Scotland in 1800. By John Leyden, edited, with a Bibliography, by James Sinton. Pp. xviii + 318. Crown 8vo. Edinburgh: William Blackwood and Sons, 1903.

Also the following Reports, etc.:—

Report on the Collections of Natural History made in the Antarctic Regions during the Voyage of the "Southern Cross." Pp. ix + 344. Medium 8vo. *Price* £2. London: British Museum (Natural History).

Handbook of Instructions for Collectors, issued by the British Museum (Natural History), with Illustrations. Pp. v + 137. Crown 8vo. *Price* 2*s.* 6*d.* London: British Museum (Natural History).

Svenska Hydrografisk Biologiska Kommissionens. Skrifter I. Plates. Stockholm, 1903.

Johann Keppler der Gesetzgeber der neueren Astronomie. Ein Lebensbild von Adolf Müller. Pp. viii + 186. *M* 2.40. B. Herder, in Freiburg im Breisgau.

Le Pérou. Par Auguste Plane. Pp. iii + 339. Paris: Librairie Plon-Nourrit et Cie, 1903.

Censo de la Población de Bolivia. Tomor I. La Paz: Oficina Nacional de Immigracion, 1902.

Report on the Administration of Coorg for the Year 1901-1902. *Price* 1*s.* 10*d.* Mercara, 1902.

Publishers forwarding books for review will greatly oblige by marking the price *in clear figures, especially in the case of foreign books.*

THE BRITISH ANTARCTIC EXPEDITION.

JUST as we go to press, the following Official Report has come to hand giving the welcome news of the safety of the *Discovery*, and the return of the *Morning* to New Zealand.

LYTTELTON, NEW ZEALAND, *March* 25.

"The *Morning*, the relief vessel to the British Antarctic exploration ship *Discovery*, has arrived here. She reports finding the *Discovery* on January 23, in MacMurdo Bay, Victoria Land. All was well on board. Only one casualty had occurred, the drowning of a seaman named Vince, who while on a sledge expedition fell down an ice-slope into the sea during a blizzard.

"Commander Scott of the *Discovery* supplies the following report of the voyage up to the meeting with the *Morning*:—The *Discovery* entered the ice-pack on January 23, in lat. 67° south. Cape Adare was reached on January 9, but from there a heavy gale and ice delayed the expedition, which did not reach Wood Bay till January 18. A landing was effected on the 20th in an excellent harbour, situated in latitude 76° 30′ south. A record of the voyage was deposited at Cape Crozier on the 22nd. The *Discovery* then proceeded along the barrier within a few cables-length, examining the edge and making repeated soundings. In longitude 165° the barrier altered its character and trended northwards. Sounding here showed that the *Discovery* was in shallow water. From the edge of the barrier high snow-slopes rose to an extensive heavily glaciated land, with occasional bare precipitous peaks. The Expedition followed the coast-line as far as latitude 76°, longitude 152° 30′. The heavy pack formation of the young ice, caused the Expedition to seek winter quarters in Victoria Land. On February 3 the *Discovery* entered an inlet in the barrier in longitude 174°. A balloon was sent up, and a sledge-party examined the land as far as latitude 78° 50′, near Mount Erebus and Terror. At the southern extremity of an island, excellent winter quarters were found. The Expedition next observed the coast of Victoria Land, extending as far as a conspicuous cape, in latitude 78° 50′. It was found that mountains do not exist here, and the statement that they were to be found is clearly a matter for explanation. Huts for living and for making magnetic observations were erected, and the Expedition prepared for wintering. The weather was boisterous, but a reconnaissance of sledge-parties was sent out, during which the seaman Vince lost his life, the remainder of the party narrowly escaping a similar fate. The ship was frozen in on March 24. The Expedition passed a comfortable winter in well-sheltered quarters. The lowest recorded temperature was 62 below zero. The sledging commenced on September 2, parties being sent out in all directions. Lieutenant Royds, Mr. Skelton, and party successfully established a record in an expedition to Mount Terror, travelling over the barrier under severe sledging conditions, with a temperature of 58° below zero. Commander Scott, Dr. Wilson, assistant surgeon, and Lieutenant

Shackleton travelled ninety-four miles to the south, reaching land in lat. 80° 18′ south, long. 163° west, and establishing a world's record for the farthest point south. The journey was acccomplished in most trying conditions. The dogs all died, and the three men had to drag the sledges back to the ship. Lieutenant Shackleton almost died from exposure, but is now quite recovered. The party found that ranges of high mountains continue through Victoria Land. At the meridian of 160° foothills, much resembling the Admiralty Range, were discovered. The ice barrier is presumably afloat. It continues horizontal, and is slowly fed from the land ice. Mountains, ten or twelve thousand feet high, were seen in lat. 82° south, the coast-line continuing at least as far as 83° 20′ nearly due south. A party ascending a glacier on the mainland found a new range of mountains. At a height of 9000 feet a level plain was reached, unbroken to the west as far as the horizon. The scientific work of the expedition includes a rich collection of marine fauna, of which a large proportion are new species. Sea and magnetic observations were taken, as well as seismographic records and pendulum observations. A large collection of skins and skeletons of southern seals and sea-birds has been made. A number of excellent photographs have been taken, and careful meteorological observations were secured. Extensive quartz and grit accumulations were found horizontally bedded in volcanic rocks. Lava flows were found in the frequently recurring plutonic rock which forms the basement of the mountains.

"Before the arrival of the *Morning*, the *Discovery* had experienced some privation owing to part of the supplies having gone bad. This accounted for the death of all the dogs. She has, however, revictualled from the *Morning*, and the explorers are now in a position to spend a comfortable winter."

The information contained in this report will give the liveliest satisfaction to all, for it entirely allays anxiety regarding the safety of the *Discovery*, which it will be remembered has been cut off from the outer world for over fifteen months. It may be of interest to recall the fact that the *Morning* sailed from Lyttelton, New Zealand, on December 6 last, her orders being to penetrate the Antarctic ice, and communicate with the British Antarctic steamer *Discovery*, which, under command of Captain Scott, R.N., left England in July 1901, and Dunedin, New Zealand, in December 1901, for the South Polar regions. During the year intervening between the sailing of the *Discovery* and the departure of the *Morning*, nothing had been heard of Captain Scott and his forty-six companions. As before stated, the *Morning* left on December 6, fully a month earlier than any ship had ever sailed from New Zealand to force the Antarctic ice. The earliest date on which news of the relief ship was expected was March 29, so that the news has come in several days sooner than was anticipated. Fuller and further details in regard to the *Discovery* and her staff are not yet to hand, but it may be assumed that, with the exception named above, all are safe and well.

Captain Colbeck has informed an interviewer that he considers it

doubtful whether the *Discovery* will be free from the ice this season. Nine of the *Discovery's* seamen have returned with the *Morning*, and Lieutenant Mulock has replaced Lieutenant Shackleton, who is invalided.

Pending fuller details in regard to the work of the *Discovery*, the following statement by Sir Clements Markham, the President of the Royal Geographical Society of London, may serve to indicate the nature and importance of the work done. The account of this work shows how much still remains to be done in the Antarctic area, and should serve as an additional argument in support of the appeal which we publish this month on behalf of the Scottish National Antarctic Expedition, which goes to a different part of the Antarctic, but which will doubtless produce results of similar interest. Sir Clements Markham says:—

"We are delighted at the results so far achieved by the British Antarctic Expedition. The *Discovery* has already well earned her name. What has been done is as much as the most sanguine could have expected. During the navigable season Captain Scott carefully examined the ice barrier, taking numerous soundings, and penetrated far beyond the furthest point of Sir James Ross. He here discovered extensive glaciated land, with lofty peaks extending as far as long. 152° 30′ west. He has already penetrated 100 miles further south than any previous explorer, and has discovered an extensive mountainous region hitherto absolutely unknown, extending to 83° 20′. This seems to indicate that land stretches to the Pole in a series of lofty mountains. This is by far the most important geographical result so far achieved in the Antarctic. Captain Scott has also succeeded in wintering with his ship 400 miles farther south than any one has previously wintered—a very important fact, which will throw great light on Antarctic meteorology and other scientific investigations. Further interest attaches to the sledge journeys, which have been carried out with the greatest skill and resolution. There seems to have been one very important journey undertaken under the greatest difficulties of intense cold and mountain travelling in the region of the volcanoes. Captain Scott himself undertook another remarkable journey southwards to ascertain the extension of Victoria Land and its character, as well as to solve the question of the ice barrier. Other sledge trips were probably made, of which we have so far heard nothing. These journeys have had far-reaching results in proving that the continent of Victoria Land extends at least as far as 83 20′ south, and probably much farther. It has been proved conclusively that the greater part of this region is a vast continent. No doubt Captain Scott sees many other problems which he can solve, and he has determined to carry on a further year's work. We expect bigger things from him, and have no doubt that he will strike east along his newly-discovered land, and probably come out in the Pacific somewhere near Captain Cook's farthest point south. The *Morning* has done her work remarkably well, and has shown how absolutely essential it was to send a relief ship to supply coals and provisions, and to bring back invalids. The explorers appear to have suffered privations, owing to the provisions having gone bad. The *Morning* has now revictualled the *Discovery*. She took out an average quantity of fresh meat."

GEO. STEWART & CO. EDINBURGH

THE ASSUAN RESERVOIR DAM FROM THE SOUTH-WEST

SKETCH BY H. M. CADELL, SHEWING THE RESERVOIR NEARLY FULL, DECEMBER 1902

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

THE DEVELOPMENT OF THE NILE VALLEY, PAST AND FUTURE.

By Henry M. Cadell of Grange, B.Sc., F.R.S.E.

Ancient records tell us that King Mena, who founded the first of the thirty Egyptian dynasties and the famous city of Memphis, showed his engineering skill by turning aside the course of the Nile some 6300 years ago. His successor, Teta, appears also to have been a practical and a scientific genius, for we are told that he continued to build Memphis, and wrote a book on anatomy. But the development of the Nile valley had been in progress long before these worthies of antiquity began their operations, and the record of its first beginnings and early growth must be sought for among the archives of unwritten history, embedded in the rocks and deserts of north-east Africa and the Arabian coast.

Most river valleys, as every student of geography knows, are of the nature of ruts worn or eroded in the surface of the land by the long-continued action of running water, and of such valleys of erosion the Grand Cañon of the Colorado river in America is perhaps the most classical example in the world. Recent geological investigations have disclosed the existence of a second class of valleys with a different history. These so-called "rift valleys" are due to great faults or cracks, and are particularly numerous in the NE. of Africa and the Red Sea area. The rift valleys are of comparatively recent geological age, and the rivers that flow along some of them, although perhaps ancient historically, are young in comparison with most of the streams in the valleys of erosion

The two famous rivers of antiquity, the Nile and the Jordan, had their courses marked out by lines of earthquake cracks which rent the whole region in two principal directions not earlier than the Miocene or Middle Tertiary period. The straight western coast of the Red Sea and

the Gulf of Suez mark the direction of one of these lines of fissure which has a general trend to the NNW. The Jordan valley, terminating in the Gulf of Akaba, runs nearly due north and south, or a little to the east of north, and this is the course of the second system of rift lines. Great rift valleys also run southwards through the Abyssinian plateau to Lake Rudolf, and give rise to many remarkable physical features in other parts of East Africa. Between the main fractures there are many smaller ones which have also produced changes of level and features of more or less importance in the geography of the region.

The valley of the Nile is not a single crack like that of the Jordan, and indeed a large part of it may not be directly caused by fracturing of the crust at all, but there is no room for doubt that between Assuan [1] and Cairo at all events the river runs more or less along lines of disturbance the evidence of which is sometimes extremely clear on the cliffs at either side. The geological history of the Nile valley has not yet been systematically studied, and the subject is one of much interest, not purely from the scientific side, but also from an economic point of view, since there is reason to believe that gold and other valuable metals, and perhaps coal, will be found to occur at different places in the unexplored desert and undeveloped wilderness of Upper Egypt and the Sudan.

From what we do know of the development of Egypt in prehistoric times it seems quite clear that the lower part of the Nile valley was at first a long narrow arm of the sea, like the Gulf of Akaba. Various borings have been made through the fine alluvium that forms the rich soil of the country, and at depths varying from 40 to over 100 feet, a widespread substratum of coarse marine sand and gravel has been found underlying the loamy soil. Rough detritus occurs mixed with this old shore deposit, detritus washed down from the neighbouring limestone plateau at a time when this country enjoyed a comparatively moist climate. This may have been the period in Egypt that corresponded with the great ice age in northern Europe. By a later upheaval the valley, with the adjacent country, was lifted above sea-level, and the river began to spread its alluvium over the rougher sediment in the bottom of the trough. The fine river mud has continued to accumulate ever since, both along the banks in the strath of Upper Egypt and on the broad plain of the delta below Cairo.

The quantity of water that passes Assuan at the upper extremity of the cultivable ground of Egypt is approximately known, and also the burden of sediment it carries. Sir William Willcocks,[2] the leading authority on Egyptian irrigation, estimates the whole quantity of solid matter that passes Assuan every year at 60 millions of cubic metres, or 2,119,000,000 cubic feet. This is a large figure, whose meaning is difficult to grasp, except by comparison, but if we imagine this mudbank heaped up and placed alongside of the Great Pyramid of Cheops, whose size is well known to all travellers, some idea may be formed of its dimensions. The pyramid, which is 451 feet high, covers an area of 13 acres, and has a volume of 85 millions of cubic feet. If one year's

[1] Spelt also Assouan and Aswan.

[2] *Egyptian Irrigation*, 2nd edition, p. 429.

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supply of Nile mud were to be heaped up in the same way it would make a pyramid with 25 times the volume of that of Cheops; or, if it were all spread over a single square mile of country, the level of the ground would be raised 76 feet.

Sir William Willcocks estimates that 36 million cubic metres, or more than half of this mud, is carried past Cairo to the sea every year, the rest going to increase the area or height of the land. If the whole of the Nile mud could be collected and used for reclamation purposes, the development of Egypt would be greatly promoted, as the quantity lost would fill up a lake 1 yard deep and 14 miles square every year. According to the same authority the mud which is being already laid down is raising the surface of the land at the average rate of 0·12 metre per century, or nearly one-twentieth of an inch per annum. Some parts of course receive much more sediment than others according to their situation, and there are large areas that receive none at all, and are therefore quite out of cultivation.

Among the latter the salt marshes and shallow lakes round the coast occupy a conspicuous place, and if these were reclaimed and freshened so that they could support vegetation, the gain to Egypt would be very great. The salt lakes in some cases are probably too deep for successful reclamation, and the cost of pumping them dry, after cutting off their communication, where there is one, with the sea, might be too heavy for the prize to be won. We have however only to look at Holland to see what can be done in this direction, and if it pays the industrious Dutch to drain the Zuyder Zee, and cultivate their one crop every year, surely the same expenditure would yield far better returns in the sunny land of Egypt, where the soil can be made to produce two crops a year at least, together of greater value than any two crops that can be raised in succession in northern Europe.

Improvements of this sort have been in progress in the Delta for a good many years, and the reclamation of Lake Abukir is perhaps the best example of what can be achieved under favourable conditions. To succeed with large operations involving heavy capital expenditure and years of unproductive work at the start, there must, to begin with, be a strong and settled Government with honest methods, and a continuity of policy that not only wins the confidence of capitalists, but also promotes their enterprise, and allows them in time to reap their well-earned harvest in peace and security.

The Abukir Company have been at work for about fifteen years under the protection of a Government such as this, and are now reaping a good harvest from these long years of toil and outlay. Lake Abukir, which lies on the coast a few miles east of Alexandria, between the Bay of Abukir and Lake Mareotis, is a saucer-shaped depression, the centre of which is about four feet below sea-level. None of this land is high enough to drain into the sea, which is kept back by means of a stone sea wall about six miles long. Before 1888, when the reclamations were begun, the lake was a huge salt evaporating basin, in whose depressions the salt lay, during summer, in sheets of dazzling whiteness, three or four inches thick, like snowy ice in cold weather at home. The lake covered

nearly 30,000 acres, or 45 square miles altogether, and was originally kept dry by pumping direct into the sea. It now drains into Lake Mareotis, a much larger and deeper basin immediately to the south-west, the water-level of which is kept down by enormous steam pumps maintained by Government at Mex near Alexandria.

Lake Abukir has been reclaimed by the simple process of washing the salt out of the soil, which is of good quality when once it is freshened. The fresh water for this purpose, which comes from the Mahmoudieh Canal, has deposited most of its silt long before it reaches Abukir, so that reclamation by means of "warping" with Nile mud is quite impracticable in this basin. The bed of the lake consists of Nile alluvium, deposited at a time when the river had free access to this district, and when reclaimed is as good as similar soil elsewhere. As soon as it is fit for cultivation it is sold in blocks to private proprietors at remunerative prices, and last year the Company were able to pay a dividend of 45 per cent., which shows that Egypt offers a good reward for skilfully conducted enterprise in the way of land reclamation and improvement.

Sir William Willcocks states that in the delta, out of a total area of 5,110,000 acres, only 3,430,000 are cultivated or in process of reclamation, 500,000 are lying waste, and 1,180,000 are under water. An enormous proportion of what is now waste and salted land was once cultivated, as the remains of ancient cities and villages testify, and might be cultivated again with the assistance of adequate irrigation works provided by Government. At some future time it may also be found feasible to dry up and reclaim some of the other salt lakes round the delta, and even along the Suez Canal, either with the help of Nile mud or with nothing but the fresh, but dirty, water that goes to waste just now. If the agricultural value of Egypt is to be maintained at its present high level—as much as £140 per acre is the price of land in good localities—the inducement to consider such new enterprises will remain very strong for a long time to come.

The bright green streak between the Libyan and the Arabian deserts, watered by the Nile and swelling out like a fan where it reaches the sea, has been well compared to the lotus, the sacred lily that figures so prominently on the tombs and temples of the ancient Egyptians. This, and not the desert hinterland, is the real land of Egypt, and the simile of the lotus is a happy one in several respects. The delta of Lower Egypt is the bell-shaped flower, in full bloom, and on the left side a heart-shaped bud is to be seen bursting from the stem a short distance below the calyx. The bud is the Fayum, a remarkable hollow in the desert, sloping down to a brackish lake, the Birket el Kurun, whose surface lies 131 feet below sea-level. The stem of the lily is long and crooked, and winds southwards over the tropical desert into the vast level plain of the Sudan, where its roots are fed by great lakes that lie far beyond the limits of Egyptian territory.

Like other plants the lily of Egypt must have grown from the root upwards, and the old fiord must have been filled with silt in its higher reaches before the flower began to swell and open out along the sea-

coast. The Fayum must have absorbed an immense quantity of mud before the old hollow was levelled up, as a boring has shown the river sediment to be as much as 428 feet deep at one place in that province. The depression is not yet nearly full, and the Kurun lake occupies the remaining part of the ancient basin. It is fed by the spent water from the long canals that run from the Nile above Assiut and irrigate the higher ground on its south-eastern side. The Fayum bud is connected with the stalk by a very narrow stem, through which the Nile water has only one access between the surrounding hills.

Not far south of it there is another and smaller hollow in the desert, the Wady Rayan, the bed of which also lies below sea-level, but it has no door to let the river in, and it remains surrounded by a ridge of limestone, salt encrusted, and dry to this day. When the proposal to construct a great flood reservoir was under consideration in 1882, the utilisation of the Wady Rayan was seriously considered, and a survey of this basin, which some people supposed to be the site of the ancient lake Mœris, was carried out by the Government. As the hollow was found quite free from old fresh-water deposits, it was clear the river could never have entered it in the past, although it lay far below the water-level, and that Lake Mœris, if there was ever such a reservoir, was in the Fayum some distance to the north. This depression may still be turned to account and used to store the surplus flood-water at some future date, as much goes to waste, especially during high floods. It would however intercept a great deal of sediment permanently, and the evaporation would tend to increase the saltness of the water, which would therefore deteriorate in quality before being released for irrigation. The Wady Rayan has an area of 673 square kilometres or 260 square miles, and with the adjoining depressions in the desert was estimated to be capable of holding 18,743 millions of cubic metres of water, or eighteen times as much as the Assuan dam can contain at present, and Mr. Willcocks calculated that it would take seven years to fill up. But the larger part is so deep that only the upper film, 10 feet thick, could be run off and made use of, reducing the available water to 1300 millions of cubic metres—only about a third more than the contents of the Assuan reservoir. For this and other excellent reasons it was clear that the Assuan scheme was the better of the two, and the proposal, suggested originally by Mr. Cope Whitehouse, to use the Wady Rayan, has very properly been laid on the shelf in the meantime.

The healthy growth of the Egyptian lily can only be maintained by a good water-supply, and it is the work of a skilful gardener to see that this department is well attended to. The success which has accompanied the repairs of the old barrage at the head of the delta below Cairo, and the practical demonstration of the enormous benefit of a summer supply of Nile water for the cotton and sugar-cane crop, has led the Government to greatly enlarge the scope of its irrigation projects in recent years. Within the last year two new barrages and one huge reservoir have been completed and added to the productive public works of Egypt, and there is every reason to believe that the large expenditure on these monumental pieces of engineering will yield a handsome return in a very short time, both to Government and to the whole agricultural community.

A barrage is merely a strong stone bridge with small arches and vertical grooves in its substantial piers, into which solid sluices or gates are dropped so as to form at certain seasons a bar or impediment to the passage of the stream. When the sluices are lowered, the water-level on the up-stream side is raised a few feet or yards, and this allows it to flow off into the main canals, whose mouths are above the barrage, and irrigate the surrounding country. The water is chiefly required in May and June for the growth of the semi-tropical cotton or sugar-cane crops, and when the summer is past and the river rises in August, the sluices are opened and the flood runs freely through. Of late years the river has been unusually low, and but for the barrages the summer canals would have been quite empty in many districts, and therefore the cotton crop, instead of being a very large one, would have been insignificant, or perhaps a total failure. As matters stand, the crop has continued more or less regularly to expand since 1885, when Sir Colin Scott Moncrieff's famous repairs on the previously useless Cairo barrage began to take effect. That year the Nile was very low, and the cotton crop was only 2,871,500 kantars or hundredweights. In 1892, which was also a bad year, the production, owing chiefly to the barrage, had risen to 5,220,510 kantars, and in 1901, the last year for which statistics are available, when the river was again very low, this sum had risen to 6,500,000 kantars, or more than double the crop of 1885. These figures are eloquent not to the Egyptian bondholders merely; they also speak to the industrious fellahîn, in language that all can understand, of the advantage of a wise and beneficent Government to a land of such capabilities as the Nile valley and the delta of Lower Egypt.

But the barrage has not only proved of material advantage to Egypt; it has also led to the abolition of the cruel system of *corvée*, under which the land has groaned since the days of Joseph perhaps, when the starving people sold themselves to Pharaoh in return for corn during the seven years' famine. The forced labour was chiefly required to clear the mud out of the summer canals, but when the water-level was artificially raised, the canals did not require to be so deep, and the tax derived from the enhanced value of the land provided funds to employ paid labour for all the work that was still necessary. The people were thus set free to work for themselves, either on their own farms or as paid labourers to a far more just and honest government than the country had ever enjoyed before.

The Delta Barrage was of no direct advantage to Upper Egypt, but in 1902 this part of the country also began to share in the general improvements when the new barrage at Assiut and the great Assuan reservoir were completed and used for the first time. The great dam occupies such a large place in the popular imagination at home that the barrages below it are apt to be quite forgotten. The new barrage at Assiut, situated 250 miles above Cairo and 233 miles below Assuan, is however a work of enormous importance, second only to the dam in magnitude, and must not be forgotten in any review of recent developments in Egypt. This barrage is the largest in the country, as it is the only one that crosses the whole river from bank to bank in one unin-

Old Rosetta Barrage, Cairo, downstream side.

Old Damietta Barrage, Cairo, upstream side.

Vessels sailing up through Assiut Barrage.

Assiut Barrage, downstream side.

terrupted line. It is a little over 900 yards long, and has 111 arches and a roadway on the top 14½ feet wide. When the sluices are down, the up-stream level of the water is raised 10 feet, and at this height it feeds the great Ibrahimia Canal in summer, which carries irrigation water far northwards along the west side of the valley and into the fertile province of the Fayum, giving perennial irrigation to a district more than 900 square miles in area.

The Assiut Barrage, which cost about a million pounds, was begun in 1898. It was completed, after four years' work, in the spring of 1902, and was used to raise the river-level in the summer months. The river was again very low that year, and but for the barrage the summer crops would have been a failure in Upper Egypt.

Contrast this great engineering achievement under British auspices with the old Cairo barrage which was begun in 1843 under the former *régime*, and after being eighteen years in construction and costing in addition to the forced labour £1,880,000, failed ignominiously to stand the pressure when it was partially tried in 1861. It then stood idle, so far as irrigation was concerned, for twenty-four years until 1885, when British engineers plucked up courage to attempt its restoration. So badly had it been built that the repairs were not satisfactorily finished and the necessary improvements on the design finally completed till the summer of 1900—fifty-seven years after the first sod of the foundations had been cut.

The reservoir dam about 3 miles above Assuan, and 586 miles above Cairo, was constructed while the Assiut barrage was in progress. After four and a half years of incessant toil it was formally opened on the 10th of December 1902 by his Highness Abbas Helmy the Khedive, the last stone of the massive cope being placed in position by H.R.H. the Duchess of Connaught, whose royal husband had laid the foundation stone on 12th February 1899, about a year after the preliminary works had been started.

The opening ceremony was, to an impartial onlooker, rather a tame affair, and much lacking in the *éclât* that might be expected to appertain to such a historic event. The function was little more than a dumb show, to the majority of the unofficial spectators who were placed so far back that it was impossible to see the water issuing from the six sluices that were opened by the Khedive at the west end of the dam. The roar of the water issuing from the other openings drowned the speeches, and none of the officials in charge had even the wit to raise a cheer, in which the outsiders would have been only too glad to join had they received an intelligible signal at the proper moment. There might surely have been a band to play the national anthem, or a gun to go off, or even a flag to haul up in lack of any audible signal, but apparently such little amenities had been forgotten by the official in charge of the function, who I am bound to say showed extremely little genius for such ornamental details in an otherwise most interesting programme. Many of the visitors, who had come thousands of miles to see the dam opened, were naturally somewhat disappointed with the externals of the ceremony, especially as they had to wait several hours in the broiling sun, in an

enclosure surrounded by policemen, minus any shelter, and without being able to get so much as a simple cup of tea or even a glass of water from the reservoir to irrigate their parched interiors.

These, however, are minor details of no historic importance. The main business of the day, which was quite well performed, was to declare the dam open and the work complete, and nobody who has seen that prodigious structure can fail to admire and applaud the giants who have so well designed the edifice and so successfully and quickly brought their work to a triumphant conclusion.

It is not my intention now to enter into engineering details. I wish rather to refer to some of the geographical and physical features of this new lake in the African desert, which appeared to me of interest as I sailed over it some time after the eventful opening day.

The Nile valley above Cairo crosses a plateau of yellow limestone, which runs far back into the desert on each side, and extends up the river to Thebes and Esna. The limestone rests on a vast flat cake of reddish brown sandstone, which crops up and produces the rugged, flat-bedded cliffs that overlook the river at intervals for hundreds of miles, and forms a large part of the desert of Nubia and the hills of the plain of Omdurman and Khartoum.[1]

The Nubian Sandstone, as this widespread dismal formation is called, rests in turn on a far older plateau of granite, gneiss, and other ancient metamorphic rocks. At Assuan the sandstone of the surrounding desert has been worn away, and the surface of the granite laid bare in the bed of the river. As we ascend the Nile, more and more of the granite makes its appearance at intervals, until in the Nubian desert wide tracts of country seem to have been entirely denuded of the sandstone under which the rugged metamorphic plateau was no doubt once entirely buried. For long distances at a time the desert railway from Wady Halfa to Abu Hammed runs over crystalline rocks and past rough granite hills covered with rounded boulders that project through the sandy plain like the ice-worn knobs and erratic blocks in our northern glaciated districts.

The hard and extremely irregular surface of the Nile granite has produced all the cataracts or rapids that interrupt the free navigation of the river between Assuan and Khartoum. Wherever the granite appears the scenery changes, and the contrast between its dark or brown, lumpy surface and the yellow crumbling sandstone beds that cover it is very marked indeed.

The site of the great dam was determined by the configuration of the valley and the solidity of the granite foundation at the place. The new lake that has been formed, although hemmed in on one side by a very plain, straight wall of masonry, constitutes altogether an extremely interesting and picturesque feature in the dry Egyptian landscape. The reservoir when full is about 130 miles long, and contains 37,612 millions of cubic feet or something over 1000 millions of tons, enough to provide the present population of Edinburgh with thirty gallons a head every day for nearly seventy years.

[1] Spelt also Khartûm.

The Opening of Assuan Dam 10th December 1902.

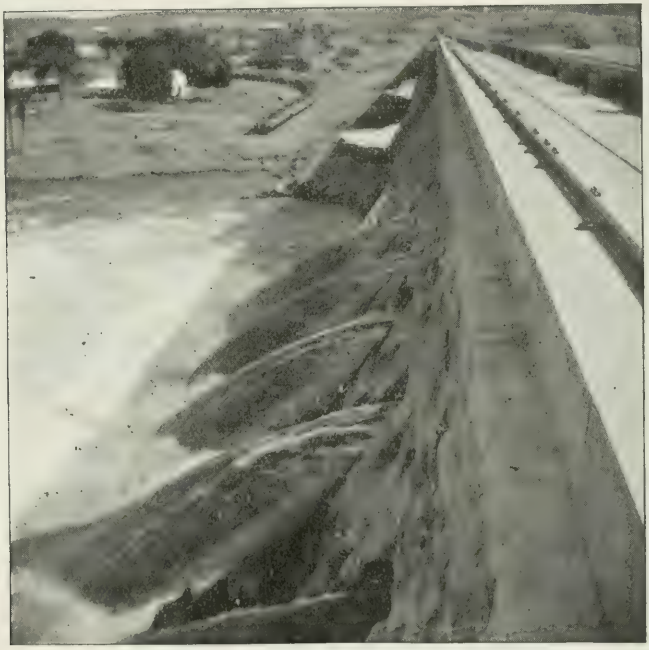
Bab-el-Kalabsha, Granite Gorge where water is 108 feet deep.

Sir John Murray's survey of Loch Maree, described before the Royal Society of Edinburgh quite recently, gives the capacity of that basin at 38,500 millions of cubic feet, which is not much more than the Assuan reservoir can hold. Loch Maree, however, has a maximum depth of 367 feet and a maximum width of 2 miles, while the new Assuan lake is only $1\frac{1}{4}$ miles broad at its lower end, and is not much more than 500 yards wide on the average all the rest of the way up to what must be considered its head at Dirr above Korosko, the place where the current of the river is first felt by steamers on the upward voyage. The length, as I have mentioned, is 130 miles to this point, and the greatest depth of water is not as might be expected immediately behind the dam, but at the Bab-el-Kalabsha about 30 miles higher up, where the valley narrows to a gorge between granite cliffs only 170 yards apart. At this defile the depth of water when the Nile is low is no less than 108 feet. (*See Sketch.*)

This deep hole among hard granite surroundings shows the excavating power of running water, and were the valley situated in northern Europe the rock basin would no doubt be ascribed to former glacial action. This explanation is, however, obviously not quite applicable here in a comparatively flat country within 10 miles of the tropic of Cancer. Crystalline rocks such as those of the Nile valley are known to be very unequal in their power of resistance to the action of eroding forces, and this is the explanation I believe of the origin of the islands and knobs of rock that make the Nile cataracts so picturesque and rugged. The islands are durable knots, and the channels between them are on lines of weakness or decomposition where the rock has become soft and easily worn away. This was clearly demonstrated in cutting the trench for the foundation of the dam. The building line crossed five channels with island ridges between, and as it was necessary to found the whole structure on absolutely solid rock, the channels had to be laid bare and their beds dressed off before building could begin. When operations were started it was found that the rock in these hollows was quite soft and decomposed, and in one case it became necessary to scoop out the rotted rock to a depth of 45 feet below the bed of the channel before a solid foundation could be reached, an unexpected piece of extra work that added considerably to the cost of the structure. Where the rock is solid it seems extremely durable, for at Assuan and on the Elephantine Island the smooth, rounded surface is at places covered with hieroglyphic inscriptions quite sharp and fresh, although they have been exposed to the weather and washed by the Nile in flood for more than 3500 years.

While among the islands another curious feature strikes every traveller. The surface of the granite between the high and low water-lines, instead of being worn away, is often smooth and glittering like polished black marble. The rock is not itself black but grey in line, and the glossy black skin has been found by analysis to be due to a film of black oxide of manganese which has crept over it in the course of ages and taken on a perfect polish. This is perhaps most strikingly displayed at the second cataract 10 miles above Wady Halfa. The

huge sandstone cliff of Abu Sîr, which towers like a giant sentinel over the cataract and commands perhaps the grandest view of the desert and the river in the Sudan, overlooks an archipelago of granite islands between which the water seethes and swirls during most of the year in a multitude of irregular channels whose navigation requires both nerve and skill. The projecting islets are intensely black and glossy, and as they glitter in the blazing sun they remind one of masses of lustrous anthracite coal rather than blocks of cold grey granite. The burnishing of the rock takes place in autumn when the flooded river, heavily charged



Front of Assuan Dam from the top.

with extremely fine mud and sand, rises in its might and subjects their faces to a thorough scrubbing before the winter season sets in.

The existence of so many cataracts, or rapids as they should more properly be described, naturally suggests another field for the development of the Nile valley, a field that has not yet been explored except in theory and imagination. I mean, of course, the application of the wasted energy of the river to the production of electrical energy. This is in itself a vast subject, demanding far more space for its discussion than is at present at my disposal, but it cannot be entirely overlooked in any paper dealing with the improvement of the resources of Egypt.

The Assuan dam when full contains, as has been said, about 1000 million tons of water. This is water gradually saved from the ordinary flow of the river after the flood has subsided in October or November.

While the reservoir is rising, the greater part of the river is still running through the dam, and as soon as the high-water level is reached, the whole of the river passes through the sluices, and spouts out with a velocity proportional to the height of the impounded water behind. This goes on until it is time to open the sluices and gradually empty the reservoir for the benefit of the river below. When the flood comes on in August all the sluices will be left open, and then if the engineer's calculations prove correct, there should be very little difference between the level of the water above and below the dam, so that during the flood season the contents of the reservoir as at present constructed will not be available as a source of power.

The object in letting the river run straight through in flood is to enable it to carry down all its supply of fertilising mud, and leave as little as possible behind to silt up the reservoir. It is certain to leave some sediment behind which the flood cannot entirely lift from the places outside the sweep of the main stream, but this is a matter on which we cannot as yet speak with certainty. It may be mentioned here that the rich red mud of highest agricultural value is contributed by the Atbara river, which comes down in flood loaded with volcanic detritus from the Abyssinian highlands.

So long as there is any water impounded between November and July, there must always be a large but varying source of potential energy capable of being utilised. The only direction in which this is employed is to work a turbine placed inside the dam which compresses the water for the hydraulic machinery that works the huge lock gates on the navigation channel at the west end of the dam. The maximum amount of power is available when the dam is full and the water issues from it under a head of 60 feet. Sir William Willcocks states at the beginning of his book on the Assuan dam that even in poor years the Nile in summer may be counted on to give 8000 cubic feet of a discharge per second, which is far too small for the needs of the country in summer. If the reservoir is full, and if for the sake of argument we take this as the quantity of water that issues from it, we find that with a fall of 60 feet the theoretical energy that goes to waste is equal to 54,000 horse power. This is, of course, an extremely generalised and rough estimate, but it serves to indicate an untapped source of wealth that may and should some day be turned to good account.

When the Nile is low, the poorer natives laboriously raise the water by shadoufs or lever-buckets worked by hand, and sakyas or Persian wheels driven by oxen, while the wealthier farmers use modern centrifugal pumps, worked by steam or oil-engines, to irrigate the summer crops. In Upper Egypt and the Fayum there are over 24,000 sakyas in operation, and 198 engines. Each sakya is extremely inefficient as a piece of mechanism, and probably half a horse-power is quite as much as its useful effect might be assessed at. The horse-power of the engines is given by Willcocks at 4995,[1] and the total for both classes of appliances is, say, 62,000. These appliances are, of course, exclusive of the

[1] *Egyptian Irrigation*, 2nd edition, 1899, Appendix IX.

shadoufs, which are too numerous to count, but I merely mention the figures to shew that there is nearly as much power going to waste at the dam, even when the Nile is very low, as would work all the mechanical pumps in Upper Egypt. These machines are only used at the season when the dam will be well filled and able to provide the power, and were the river passed through large turbines with dynamos and cables attached, and thus harnessed to the pumps instead of the patient oxen or the costly steam-engines, another vast stride might be made in the advancement of the Egyptian state.

Sakya or Persian Wheel Pump worked by Oxen.

The utilisation of the water-power of the Nile is however by no means confined to the Assuan district. There are five other cataracts between Wady Halfa and Khartoum, on some of which weirs might be constructed to produce a better fall, and concentrate the water-power at certain places where it might be profitably employed. Above Assuan there is hardly any cultivable land, and the desert comes close down to the river for hundreds of miles along its course, until the great plain of the Khartoum provinces and the so-called island of Meroe is reached. At present the only use a power-station on that part of the river could be put to would be to supersede steam on the Khartoum railway. The railway cuts off the great loop of the Nile between Wady Halfa and Abu Hammed, at the head of the fourth cataract, when it comes down to the river again, after a run of 232 miles, across the dry Nubian desert. It roughly

follows the river for the remaining 328 miles of its course to Halfaya, opposite Khartoum. The price of coal in that part of the Nile valley is from £4 to £5 a ton, and if the railway could be worked by electricity derived from the neighbouring cataracts, a great saving in fuel might be effected. But until the trade of the Sudan is better developed, and there is more outlet for a large supply of electrical energy in that remote country, the prospects of utilising the waste power of the river on a successful commercial scale are as yet extremely small.

There may, however, before long be a new customer in search of motive power, one who may quite change the aspect of affairs in the Upper Nile valley and the deserts that adjoin it. The discovery of gold has altered the face of the desert in more countries than one, and it is possible that the recent discovery of workable reefs in the Nile valley may produce similar changes here. When I was at Assuan I happened to meet Mr. Charles Neufeld, one of the Sudan celebrities, well known to readers of recent Egyptian history, who now seems to spend most of his time in organising mining ventures in the desert. He told me that he could trace the evidences of ancient mines with certainty, and that the desert was dotted with them at certain places known to him. The stories of gold-mining explorers must be taken with more than the proverbial grain of salt as a rule, but there is no doubt that some prospects of payable reefs have lately been disclosed, and the mine at Um Garaiart, four days' camel journey from Assuan, belonging to the Nile Valley Company, has yielded a good deal of "specimen stone" which has, of course, been widely advertised. Auriferous reefs have also been struck in the Nubian desert some distance east from the railway, among the granite rocks and schists I have already spoken of, and there seems no geological reason why valuable metals should not be found here as well as in similar rocks in India and other places. The land of Ophir may, after all, turn out to be Upper Egypt, and certainly it is much more natural to suppose that Solomon obtained his gold from the nearest mines to his own kingdom than that he went all the way to Rhodesia, as various recent writers have proved to their own satisfaction.

For hundreds of years many splendid mines known to exist in countries under the execrable sway of the Turk have been kept resolutely closed. A fellow-traveller, a native of Smyrna, in business in Cairo, who had travelled for sport all through Asia Minor, told me he had once visited the mines of King Crœsus, which had shafts of large dimensions lined with slabs of polished, white marble, and pieces of rich auriferous quartz could be picked up round them. These mines are probably still valuable, but the Sultan, dreading an invasion of enlightened Uitlanders, absolutely prohibits any European from attempting to re-open them. This is only one example illustrative of the baneful effect of the old style of government from which Egypt has happily been lately delivered. If a government such as that of the Khedive and Lord Cromer could only be extended to the rest of the Sultan's dominions, the centre of gravity of the whole mining world would no doubt soon be shifted a considerable way further north.

The recent discovery of workable gold in Upper Egypt has already

begun to dazzle the London mining market, and a crop of subsidiary companies is springing up before even the success of the present company has been permanently assured. No less than twenty new companies and syndicates have been registered, with capitals varying from £600 to £250,000, and a total nominal capital of £1,169,100 to work and develop the mines of Egypt and the Sudan (*Statist* of 7th March 1903). It will be a repetition of the old story, no doubt: hundreds will rush into mad speculation in Egyptian mines, as they did in West Australians in 1894, in New Zealands in 1897, and in West Africans in 1900, and after thousands and perhaps millions of pounds have been squandered between the desert and the company promoters, the great majority of the shareholders will retire in disgust, and only a few genuine mines will perhaps be left alive on the field. The absence of rain and the heat of the desert in summer will always be great obstacles, but if the Nile is harnessed in the way I have suggested, both power and water may be carried across the desert for considerable distances, and the natural difficulties considerably minimised. The Nile Valley Company have already found water at some depth, and if this proves sufficiently sweet for use, power alone is needed to raise it for domestic and mechanical purposes; but in many cases such water as there is may prove to be impregnated with salt, and whether wet or dry, no Egyptian mine, unless extraordinarily rich, can hope ultimately to succeed without the help of the Nile in one shape or another. It is thus clear that profitable mining on a large scale will be principally confined to places within a certain radius of power-distributing stations that may be constructed on the river.

The Assuan dam is capable of enlargement, and the base has been so substantially built that the superstructure can be raised about 20 feet without the necessity for extending the foundations. If this is done, the capacity of the reservoir will be doubled, and 30 per cent. will be added to the head of water available for power at the sluices. The original design of Sir William Willcocks contemplated a higher dam, and the building was lowered for the following sentimental reason.

On the picturesque island of Philae, about a mile above the dam, stands a group of interesting temples, of various ages, dedicated to Isis and other ancient Egyptian deities. The proposed partial submergence of these ruins, which the original design of the dam involved, raised a howl of indignation on the part of some antiquarians and many more less-informed people, who showed extremely little capacity for judging of the relative intrinsic values to Egypt of its ancient and modern engineering monuments. So loud raged the storm that the Government rather weakly, I think, gave way, and ordered the height of the dam to be reduced considerably so that only the floor of the temple should be covered when the reservoir filled up. The engineers had proposed to raise the buildings up above water-level where they stood, or to shift them up to the top of the high adjacent crag of Bigeh Island, which overlooks Philae. But it was decided to leave the temples standing and underpin the foundations, where these were on soft ground, rather than attempt to move them as suggested by the engineers. Those who have only heard the din of the Philae controversy from afar might be led to imagine that there

Philae as seen from Shellal, with Bigeh Island on left, and Wall of nearly full Reservoir in distance.

were no other temples worth speaking of throughout the length and breadth of Egypt, whereas these are only a few, and not by any means the finest or oldest of the ancient sacred edifices of the Nile. When we consider the enormous value of the reservoir to the toiling millions of Egypt, and the greatness of the whole scheme both in conception and execution, the value of the temples, which is purely artistic and antiquarian, dwindles to insignificance in the comparison. In a few years Philae will be overlooked when the utility of the dam and the need of raising it higher becomes apparent. The isle is no doubt a

The Kiosk or Pharaoh's Bed, Philae, as partially submerged when Reservoir full.

lovely object, and the accompanying photos I took in January after the dam was full, when visitors were for the first time rowed in boats past the colonnades and through the massive pylon gateways, show that it is still beautiful, as well worth a visit as it was before the vulgar hand of the modern utilitarian had been put forth to stem the river and drown the floors of the sanctuary in the rising flood. It must, moreover, not be forgotten that the reservoir will not always be full, and when the water is low the Philae temples will stand as of yore on dry ground. Part of the buildings rest on granite, and the water will not affect their stability, but the splendid Temple of Trajan, known also by the Kiosk and Pharaoh's bed, as well as the colonnades and other buildings, rest partly on Nile mud and sand, and these have been underpinned under the superintendence of Major Lyons, R.E., the able head of the Survey

Department. The underpinning should prevent any serious subsidence due to the softening of the soil, but until the water subsides its precise effect on the stability of the buildings cannot confidently be predicted. Some of the old Egyptian temples are badly founded, and on the 3rd of October 1899, as the flood was subsiding, eleven of the huge columns in the great hall of the famous temple of Karnak suddenly toppled over and so damaged three others that they had to be taken down also. The Government devoted £4000 to the re-erection of the fourteen giants, and it is to be hoped that the maintenance of the Philae temples will not prove expensive after their annual bath, but even if they do, the reservoir will be able to bear a far greater financial burden than this for many a year to come.

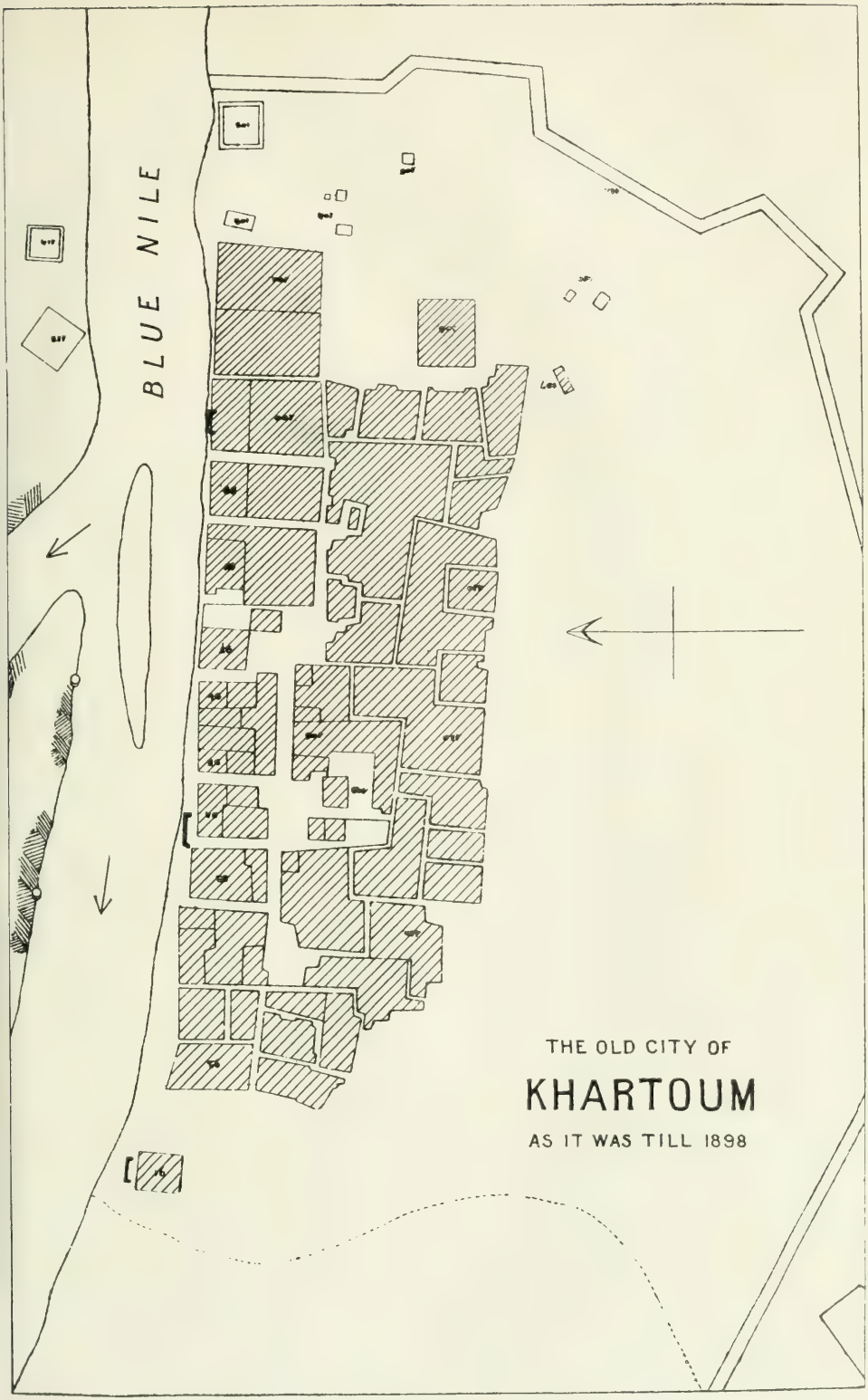
Between Assuan and Khartoum the capabilities of much improvement do not at present seem very great. What is most wanted for the Sudan, which begins a short distance below Wady Halfa, is a railway connection with the Red Sea coast. Without this direct outlet the trade of the Sudan can never be very great. At present the merchandise from Khartoum, which is 1860 miles from the Mediterranean, has to be transhipped at least four times before reaching Cairo, and once or twice more before leaving Egypt, and this so increases the freight that competition with the outside world is extremely difficult for most kinds of produce. The Berber-Suâkim railway, across 245 miles of dry desert, will, it is intended, be completed in about two years' time, and then, but not till then, the commerce of the Sudan will have a fair chance of ripening. The completion of this line, besides making the Sudan more independent of Egypt, will shorten the journey from Khartoum to the coast by 1190 miles, and will give a direct outlet without any transhipments on the way.

Khartoum is well fitted by its position at the junction of the two navigable branches of the Nile to become a great commercial emporium, and the metropolis of this part of Africa. Five years ago, after the war, the town was nothing but a heap of dust and ruins, but now the foundations of a handsome metropolitan city are being well and quickly laid. The change is marvellous, and to show what is being done, I have been permitted by Colonel E. A. Stanton Bey, the Mudir of Khartoum, to reproduce a map of the new city, which he kindly allowed me to trace from the official plan in his office. This is the latest map, and on it are sketched the principal buildings. The streets are, of course, not nearly completed, and many of them are only pegged off on the centre line. They are laid out on a regular, well-considered plan, in a geometrical, but not a slavishly symmetrical system, such as American builders delight in. The northern boundary of the city is the Blue Nile, along the crest of whose left bank runs the River Esplanade, a fine street on which the principal public buildings are erected. Foremost among these the palace of the Sirdar, within whose precincts the great Gordon met his cruel fate, rears its simple but noble front with chaste white walls commanding the river, and a handsome arched and pillared façade looking out on the blooming gardens behind. The palace is built just a little too near the edge of the river to get the justice its position

The Palace, Khartoum, from the Garden

Government Buildings on Khedive Avenue, Khartoum.

PLAN OF THE NEW CITY OF
KHARTOUM
SCALE OF HALF A MILE
1903
British Barracks
Gordon Memorial College
Gordon's old Fortifications
Hospital
RIVER ESPLANADE
MOHAMMED ALI STREET
Sudan Club
Church Site
Works Dep.t
SIRDAR AVENUE
Stables
Public Garden
Palace
Gordon Statue
VICTORIA SQUARE
AVENUE
STREET
Govt Bdgs
Mosque
Post Office
Bank of Egypt
Nat.l Bank
KHEDIVE
ABBAS
PASHA
MORTAZ
Markets
ABDEL AZIZ STREET
Mudiria
Church Site
MUSSA PASHA STREET
Hotel
Public Gardens
Tuti Island
BLUE NILE
Sandbank, foreshore covered at High Nile
Low Nile
Buildings
Line of Boundary
4th or lowest Class of Buildings
2nd Class Building Zone
3rd Class Building Zone
Blocks partly built upon 1903


BLUE NILE
THE OLD CITY OF
KHARTOUM
AS IT WAS TILL 1898

Sudanese Sheep, and Mosque in course of erection in Abbas Square, Khartoum.

Bank of Blue Nile at Khartoum, showing new Hotel and Gordon's old Steamer *Bordein*.

demands, and if it had been placed only twenty feet further back it would still have covered the sacred spot where Gordon fell, without limiting the breadth of the handsome esplanade in front.

On the west side of the palace are the Government Buildings, which accommodate the chief officials of the Sudan Government from the Sirdar downwards. This large block stands well back from the River Esplanade at the rear of an open space suited for a parade-ground, and ornamented with numerous purpose-like pieces of ordnance. The building is of red brick of substantial but tasteful design, and like the palace its best face looks southwards to the Khedive Avenue across a public garden in course of construction. The accompanying photographs which I took before I left Khartoum on 3rd January will convey some idea of the southern elevations of these handsome buildings.

Among other prominent edifices are the General Post Office, the Mudiria, the office of Colonel E. A. Stanton, the able governor of the province of Khartoum, and the Mohammedan mosque for the Moslem inhabitants in course of building in the centre of Abbas Square. At the extreme west end of the River Esplanade are the pleasantly laid-out municipal gardens with many species of tropical trees and shrubs and flowering plants kept fresh by constant irrigation. Next the gardens is the new hotel in the midst of a grove of palms, which was formally opened by the Mudir on Christmas day 1902. The hotel is built and maintained by the Sudan Development Company, who are bound by Government, in part consideration of their concession, to provide for visitors in this way. It so happened that on the opening day there were only two resident visitors, a German artist and myself, to respond for the guests. The only guest who could do so in the English tongue said that he had come to the Nile primarily to see the great dam opened, but now he felt he was let in for the opening of another kind of reservoir. The hotel was intended to be a reservoir to intercept for a time the valuable stream of visitors which, next to the great river, was apparently the most important fertiliser of Egypt. As the water in the reservoir would leave valuable sediment in the mud banks above the dam every year, so the stream impounded in the hotel would, he hoped, leave a valuable deposit in the banks of Khartoum each season, a hope which the assembled company cordially endorsed. The hotel has accommodation for sixty guests, and I found it extremely comfortable and well managed, and at the same time moderate in comparison with the other hotels in more civilised parts of the Nile valley.

Khartoum can boast of two competing banks, the National and the Bank of Egypt, and the sites allotted to these institutions must sometimes be a little embarrassing to one or other of the respective agents. They are situated exactly opposite one another on the Khedive Avenue, so that each agent has a full view into the windows of the other, and can study his competitor's customers and number of daily transactions fairly accurately. One of the agents, I need not say which, who is fond of animals, keeps a young lion on the premises for a pet. The effect of bears in the Stock Exchange is well enough known in financial circles already, but the precise effect of lions in banks may be more difficult to

calculate, especially their effect on attracting new customers to the establishment.

The Khedive Avenue, which is still under construction, is a noble street 150 feet wide and 2 miles long, with double rows of lebbek-trees (*Acacia Arabica*) at either side, and footpaths 30 feet broad. It runs east and west parallel to the River Esplanade, from the municipal gardens on the west side of the hotel to the line of Gordon's old fortifications at the extreme east end of the city. The trees are as yet quite small, and need an ample supply of water to give them a fair start, and only the central section of the avenue is yet planted and approaching completion as a thoroughfare. The narrow-gauge public works' railway, with its toy locomotives and miniature trucks, traverses the avenue from end to end, and runs out into the dusty plain at each extremity. In the centre, opposite the Palace Gardens, stands the new Gordon statue, and the other and far greater monument to the hero of Khartoum, the Gordon College, rises gaunt and bare in the midst of a treeless sandy enclosure several acres in extent between the river and the extreme east end of the avenue.

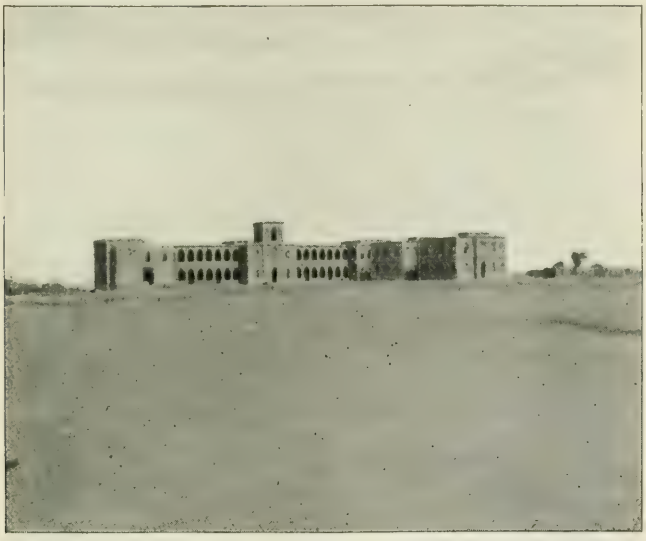
All the streets are broad and straight. The Victoria Avenue, which is the widest, is 180 feet in breadth and runs southwards from the Gordon statue, so as to bisect the city into equal parts. The minimum width of the other streets is 80 feet, with 15-feet footpaths on which trees can be planted.

The Gordon College, it may be remembered, was built from subscriptions raised at home in a moment of national enthusiasm and gratitude when Lord Kitchener's decisive victories over the dervishes in 1898 had brought peace and security back to the Sudan, and had opened an era of new life and prosperity to a vast region. Lord Kitchener's request for £100,000 to establish a college to keep green the memory of the hero of Khartoum, by elevating the lives of some of the ignorant inhabitants of the Sudan, had only to be made to be heartily responded to. £140,000 was soon provided, and some £20,000 of this has been spent in the actual erection of the college buildings. The funds, as has been said, were provided here in a burst of enthusiasm, and the scheme was initiated with the best of intentions. But after the lapse of five years, we who contributed our mite to the pile may be permitted to look back and forward, and ask in calmer frame of mind whether our zeal did not outrun our discretion on that occasion, and whether, after all, the institution in its present form is likely to be the best way of perpetuating the memory of him whose great name it bears.

The huge red brick building, with its long corridors and spacious dust-covered halls, silent and empty, is certainly a remarkable edifice, and its comfortable and jovial director, Mr. Currie, has a remarkable office to fill. The building, as originally planned, was to consist of a central two-storey block with wings at the ends, forming together three sides of a quadrangle facing south. To Mr. Currie, I believe, belongs the credit of leaving the building of the western wing over till it is likely to be required. To all appearances this will be a long time, as the most important ingredient in a school is the scholars, and at present

the prospective scholars are a few hundred children learning the three R.'s in mud-walled schools at Omdurman and other places, which have ample accommodation for the class of pupils to be educated.

Education is of course at the bottom of all civilisation, but too much of it is nearly as bad as too little in some communities. We have in India experience of this, where a large class of clever natives has arisen, so well educated as to despise commercial and manual work, and for whom not enough of intellectual posts are available. A crowd of discontented young men is thus manufactured, who may become a permanent menace to the Government. In the Sudan the minor posts in the Government must ultimately all be filled by natives accustomed to the tropical climate, and there will always be a certain number of posts



Gordon Memorial College, Khartoum.

where the college graduates will find good openings. But at present the Sudan is almost empty of population, and has not nearly recovered from the devastations of the Mahdi's wars, and what is wanted chiefly is an industrious peasantry like that of Egypt, to cultivate its fallow land and develop its trade and commerce, rather than a high condition of education on the part of the natives.

Another aspect of the question is worth attention. The Sudanese natives are largely pagan in religion, and the faith of Mohammed is not nearly so powerful among them as it is in Egypt. Lord Kitchener prohibited any attempts at teaching the Christian faith in the college, but what if the teachers, who will probably be all natives in the junior classes at least, should use their influence for the spread of Mohammedanism among their pagan pupils? Apart altogether from the religious aspect of the matter, it seems reasonable to suppose, merely from a

political point of view, that as a Christian state the Sudan would be a better part of the empire than a Mohammedan one. Our king already rules over a dangerously large number of Moslem subjects, who at any time might rise against him. It is not very long since the cry, "Down with the Christians!" was raised by the mob in Alexandria, and had the authorities not taken prompt measures to restore order the fanaticism of the people might have spread with disastrous results.

For fear of the Mohammedans in our Eastern Empire, we dare not raise a finger against the unspeakable monster who rules at Constantinople, and surely it is only common-sense policy to build up, in what is

Corridor in Gordon College.

practically a new country, a state on lines that are likely to be a pillar of strength to our rule rather than a permanent menace such as we already have to face among populations where the faith of Mohammed preponderates.

I have no doubt Lord Cromer and the admirable rulers of the Sudan have given full consideration to this important side of the question, but the subject naturally suggests itself to a visitor to the Gordon College; and as the institution was founded by people professing the Christian faith, they naturally would be sorry if it were to be conducted on lines that might prove in any way a future danger instead of a support to the Empire and humanity at large.

Wherever the British flag is flying there is sure to be a club, with

newspapers and tennis courts, and among the institutions of Khartoum the excellent Sudan Club holds an appropriate place. It stands in a shady garden, midway between the Khedive Avenue and the river, on the west side of Mohammed Ali Street, and some of my friends among the Government officials were kind enough to make me an honorary member during my visit, an act of hospitality, it need hardly be said, I greatly appreciated in that remote part of the African wilderness.

These and other public buildings, and some private official residences, are built on the first-class section of the city between the river and the Khedive Avenue. The second zone parallel to this is bounded on the

Sudan Club, Khartoum.

south by the Sirdar Avenue, and is intended for good two-storey buildings of a smaller class. The third section extends between the Sirdar Avenue and the centre line of Abbas Square, and in this one-storey houses of a smaller class may be built. All to the south of No. 3 zone is reserved for the native mud-walled houses and lowest class of buildings, but the true native quarter of the future will probably be the city of Omdurman just below the junction of the Blue and the White Nile, where almost all the buildings are of the lowest architectural class, and the natives live close to the river beside their work.

While these well-considered plans have been made for the capital of the Sudan, it is only proper to remember that although wonders have been done since 1898 in the way of laying-out, planting, and building,

the city is still largely in embryo, and until the trade of the country develops, and the Sudan has enough revenue to be self-supporting, the rate of national growth will be comparatively slow.

Khartoum stands on a vast, practically uncultivated plain that requires irrigation to become productive, and as yet little or nothing has been done in this department. But even with the necessary water the district cannot flourish until there is encouragement for farming in the shape of a good market for the crops, and this will not be found until the Suâkin-Berber railway is opened.

Something can no doubt be done for irrigation near the river by employing windmills to raise the water in the absence of barrages and canals, as there is often a good deal of wind at Khartoum. The sudden hurricanes or hibûbs that sometimes make their appearance are, however, apt to overthrow even well-braced wind-motors of the modern type, and in these circumstances it may be found better to adopt windmills of a new type which a few makers sell, constructed with a vertical shaft and horizontal arms, fitted at the ends with cup-shaped sails, like huge anemometers. With mills of this sort, which face every wind, there is less risk of danger from a sudden swirl of the wind catching the sails in the rear- before the wheel has time to face round, and there is also less mechanism to get out of order.

The trade of the Sudan consists chiefly of three exports—gum arabic, ivory, and ostrich feathers, and Omdurman city, about 4 miles below Khartoum, whither fleets of boats bring their merchandise from the interior, is the emporium for these products. The total value of the gum exported is about £200,000, and of the others not more than about £100,000 together, but as the country is settling down these figures are gradually growing larger. More variety is however badly required if the Sudan is to flourish and become independent of support from the Egyptian treasury, and it is the interest of Government to look out for new sources of revenue.

I happened at Khartoum to meet a friend, Dr. F. H. Hume of the Egyptian Geological Survey, who took me with him as far as Duem, a town 100 miles up the White Nile, where he was measuring the discharge of the river for the Irrigation Department at Cairo. This was the end of my Nile voyage, and as I wish only to speak of what I have actually observed, I shall not wander much further afield in this paper. But even in that extremely uninteresting part of the Nile valley a few interesting points are worth noting. One of these is the total cessation of palm-trees above Khartoum on the White Nile. Dates are valuable, and the planting of palms would, no doubt, assist the future development of agriculture on the river banks. Eucalyptus-trees might also be grown for fuel if for no other purpose, and the Jarra, one of the eucalyptus tribe which flourishes in Western Australia, might prove a valuable timber product for paving streets of large cities in Europe. The only forest vegetation to be seen near the river is rough acacia, and much of this has been cut for fuel for the steamers that ply on the White Nile. If a better supply of fuel is not forthcoming the steam navigation will become ever more expensive, as the natural woods cannot grow up nearly as fast as they are being cut down on this part of the river.

As Dr. Hume and I were returning from Duem, we stopped to take in some of the acacia fuel at a village of beehive straw huts called Tura on the right bank, some 50 miles above Khartoum. The surrounding country is a level plain across which the river flows between low banks covered with pale green, fleshy-leaved Sodom apples, growing in bushes 8 to 10 feet high (*Solanum sanctum*), a desert fruit, whose juice is extremely poisonous to the eyes. On looking at the low bluff facing the river, which had the appearance of an ordinary alluvial bank, we were surprised to find that it was not a bed of recent alluvium as we expected, but an older formation covered by the recent flood deposits, through which the river had excavated its channel. This older deposit was a greyish, sandy clay, with white quartz pebbles sticking in it, but what was more interesting was the discovery of fossil bones of animals and fish scattered through it in considerable quantities. These remains proved to be of some geological importance, and on my return home I submitted them to Mr. Smith Woodward of South Kensington Museum, who said they belonged to a siluroid fish and to *Polypterus*, one of the genera still swimming in the Nile, but the most interesting specimen he declared to be a broken canine tooth of an extinct giraffoid animal related to *Samotherium* and *Sivatherium*. These remains point to the existence of a widespread formation in this part of Africa contemporaneous, perhaps, with the Tertiary beds in the Fayum, in which enormous numbers of bones of extinct mammals have lately been discovered.

Wishing to further examine this deposit which we found cropping out at Ze-if, a place on the right bank about 10 miles below Tura, we hauled up there for a short time, and made another inspection. The bed was greyer in colour, and no fossils were to be seen, but I happened to notice a spot darker than the rest of the matrix, and on digging into it a fragmentary piece of black coal was discovered which, when fresh, had the characteristic bright lustre of the genuine old black diamond. On further hunting a second but inferior fragment was found in the bed, but our time was too limited to let us prolong the interesting investigation further. The piece of coal was of no intrinsic value itself, and the stratum in which it occurred is not likely to prove coal-bearing, but it indicated that when the bed was laid down, probably in a great lake overspreading this river, there was a seam of coal cropping out somewhere in the district or along the shore whose fragments were washed away, and sank among the mud and gravelly sediment in the water. What has been discovered is merely the smell of the prize, the scent of the quarry so to speak, and to reach the quarry, or rather the mine that it is desired to capture, may require much patient hunting. If it should happily be reached, the gain to the Sudan will be considerable, as coal costs £4 or £5 a ton at Khartoum, and a reliable supply of good fuel is badly wanted for steam-raising purposes. But supposing workable coal were to be found, the local demand is scarcely great enough to keep a colliery regularly going yet, and if a mine were to be opened up, the best thing would be for Government to work it for their own engines to begin with.

The fragment of coal from Ze-if I was glad to have an opportunity of

presenting to the Sirdar, Sir Reginald Wingate, whose hospitality to visitors and zeal for the advancement of the Sudan are much appreciated on all sides. I suggested the advisability of having a systematic geological investigation of the district carried out, as the province of Khartoum is practically a geological *terra incognita* as yet, and there is no knowing what may be found under the unpromising surface. Large quantities of magnetic iron sand occur, for example, in the bed of the river, and can be lifted in cakes at places where the water is low. By dredging the river-bed, especially below the granitic areas, it may be possible to find gold, and in New Zealand it pays to dredge rivers for gold, if there is only a grain or two per ton of gravel.

Dr. Hume, writing on 18th March, says my suggestion was acted on, but nothing has been found as yet. Lord Cromer, who visited Khartoum a short time after I returned to Cairo, had his attention drawn to the matter, and in his strong and busy hands we now may safely leave the further consideration of the best means of developing the resources of the Nile Valley, and improving the welfare of its inhabitants.

Since this paper was printed, I have obtained from the Survey Department in Khartoum an old map compiled by Colonel Slatin in 1898, which is here reproduced (p. 241), and will serve to indicate the nature of the contrast between Old and New Khartoum.

THE BRITISH ANTARCTIC EXPEDITION.

Since our last issue some further details in regard to the work of this expedition have come to hand, and are here reproduced from the daily press. The sledge expedition to the south made by Captain Scott, Dr. Wilson, and Lieutenant Shackleton, in which they reached the furthest point south ever attained, was of the most arduous character. The journey occupied 94 days. After the explorers had left a depôt which had been previously established 60 miles to the south of the ship the snow became soft, and it was almost impossible to drag the sledges along. Half of the sledges had to be hauled 5 miles, and then the party returned and brought up the remainder, each 5 miles covered thus involving 15 miles' travelling. This relay work lasted 29 days.

The explorers established a depôt in latitude 80° 30′ south. Here they discarded all superfluous gear and set out from the depôt on December 15 for a dash to the south, taking with them only four weeks' provisions. As they proceeded the snow became softer, and the extra strain told quickly upon the dogs, which ultimately all died. The furthest point south made was 82° 17′, not 80° 17′ as previously stated, and at this point the party were compelled to turn back.

The return journey was still more trying. Thick fogs enveloped them, and for five days the party had to steer a course practically in the dark. Then they had to go on short rations, and to add to their difficulties Lieutenant Shackleton burst a blood-vessel in one of his lungs. Such were the hardships of the sledge work on the various

journeys made by the *Discovery's* men that they are described by the officers of the *Morning* as being palpably aged, though nevertheless well and cheerful.

A party under Lieutenant Barnes were returning from a sledge journey to Cape Crozier when a blizzard struck them 10 miles from home. Lieutenant Barnes abandoned his tents and sledges, and left the dogs to find their way to the vessel. Snow fell so heavily that the party could not see two yards ahead. While they were descending a slope Seaman Vince disappeared. His companions then discovered that they were within a few yards of the edge of a huge precipice. Seaman Hare had a wonderful escape. He got separated from his party and lost the track. He fell from sheer weariness, and a search party sent after him gave him up as lost. Hare slept under a snowdrift for thirty-six hours, and rejoined the ship unharmed.

Lieutenant Armitage, second in command, on a sledge journey which he made to the westward, and which lasted fifty-two days, attained an altitude of 9000 feet. The party descended an ice slide to a glacier 3000 feet below. At one point of the journey they slid a distance of 1300 feet in one minute ten seconds, hanging by straps to the backs of the sledges. On the return journey Lieutenant Armitage fell into a crevasse, and hung 30 feet below the surface. If he had not been harnessed to the others he would have fallen a depth of 2000 feet. In some places the sledges had to be lowered 50 feet, and then hauled up on the other side.

At Cape Adare the *Discovery* found Mr. Borchgrevink's huts in good preservation.

The names of the *Discovery's* crew who returned on board the *Morning* are Lieutenant Shackleton, Petty Officer Macfarlane, Seamen Hare, Hubert, Peters, Page, Walker, Duncan, Buckridge, and Brett. Their places have not been filled as Captain Scott still has forty-one on board the *Discovery*.

Some uncertainty still exists as to the exact plans of Captain Scott. His instructions were to return to New Zealand with the *Morning*, and it is probable that he had at first some intention of doing this, but from the information as yet received from Captain Colbeck, it would seem that Captain Scott meant to seek new quarters from which to continue his work, should the ice not break up in time to allow of his return. This statement seems to indicate that the *Discovery* had been frozen in, and that communication between her and the relief ship, *Morning*, had to be carried on over the ice; if so, this would greatly increase the difficulty in transferring stores. Captain Colbeck seems so doubtful of the *Discovery's* being able to make her way out this season that he insists on the necessity of making preparations to send out the relief ship again next season. Although, unfortunately, much of the tinned food supplied to the *Discovery* is useless, the expedition has an ample supply for the next twelve months, thanks to the additions which the *Morning* was able to make to her larder. Although there seem to have been symptoms of scurvy on the sledge journeys, these entirely disappeared on the return to the ship, and Captain Colbeck is confident

that no anxiety need be felt if there is no further news of the *Discovery* this season. All who are now on board are volunteers for whatever service may be required; all the men are A.B.'s, full of enthusiasm and loyalty, and in number are quite sufficient for the work to be done.

Another suggestion that has been made in regard to Captain Scott's plans is that immediately on being refitted from the *Morning* he started eastwards, skirting along the ice-barrier, in the hope that he might be able to get out of the ice before the winter set in. Should this supposition be well founded, it is possible that the first news of the *Discovery* may come from the Falkland Islands, and may reach us within the next few weeks. But the general consensus of expert opinion is that if Captain Scott is making such an attempt he is not likely to succeed in escaping this season. In that case he will have either to find some sheltered spot in which to establish fresh winter quarters, or to allow the *Discovery* to be frozen into the ice, as was the case with the *Belgica* some few years ago. The movements of the *Morning* will, of course, depend on Captain Scott's plans.

While the news of the work accomplished by Captain Scott has been everywhere received with great satisfaction, a painful impression has been created by the news of the outbreak of scurvy on board the *Discovery*, and by the defects in the provisions and stores with which the expedition was supplied. It has been stated on unknown authority that large quantities of the provisions were damaged by sea-water, as the result of the leaks which the ship developed while on her voyage to the Cape, and which, on her arrival at Lyttelton, were found to be of so serious a character that it was necessary to dry-dock the ship and make somewhat extensive repairs. Nothing is known officially as to any large quantity of provisions having been thrown over at Simon's Bay, but should it prove to be the case that the stores have been materially damaged by sea-water, that will naturally raise important questions with reference to the building of the ship. It will be remembered that the *Discovery* is the first vessel which has ever been built in this country for purely exploring purposes. She was built in a Scottish shipbuilding yard to special designs, and cost a very large sum of money, the heavy expenditure being justified on the ground that it was necessary to use none but the best materials and to spare no precaution in building a ship on which not merely the comfort but the lives of the members of the expedition might depend. Elaborate precautions were taken to secure that none but the very best provisions were put on board, and as the stores taken were ample for at least three years, it is difficult to understand how the members of the expedition can have suffered privations before the arrival of the *Morning*, unless very large quantities indeed of the stores were found to be defective. Final judgment must be suspended until the facts are more fully known, but none the less those already disclosed have given rise to some comment.

The author of an article in the *Times* points out that as yet it is not quite easy on the basis of the necessarily condensed report which has reached this country to make out exactly the details of the work accomplished by the expedition. But, so far as the land is concerned, it is

evident that Captain Scott has added a large area to our existing maps, and very considerably modified the outlines of the coast-line as already laid down. The particular section of the Antarctic in which the *Discovery* has been at work lies almost directly south of New Zealand. It takes the form of a great bay, bordered on the east by what is known as Victoria Land. At about 78 S. it turns westward for a distance hitherto undefined, bordered all along by a great wall of ice which was supposed to be impenetrable. Our knowledge of this region is mainly due to Sir James Ross, who, sixty years ago, in the *Erebus* and *Terror*, laid down the features with which students of geography are familiar. Subsequent expeditions added scarcely anything to what Ross had discovered. The *Discovery*, which left Lyttelton about Christmas, 1901, struck the ice on January 2 or 3 (not 23, as stated in the first report), and about six days later made Cape Adare, the most prominent landmark coming from the north. The *Discovery* at once coasted along the great ice barrier, and found that since Ross's time the barrier towards its west end had moved round in a northerly direction. The *Discovery* here followed the coast-line for about 120 miles further than did Ross, and discovered a land, conjectured by Ross, with high glaciated slopes, from which protruded bare precipitous peaks; in fact, we have here almost a repetition of the Greenland landscape. Here, then, we have an important addition to our knowledge of the Antarctic in what appears to be an extensive area of glaciated plateauland. On its way back the *Discovery* found an inlet near where Mr. Borchgrevink left his ship and a sledge party went southwards to 78° 50′. So far as can be made out, the expedition wintered to the east of Mount Erebus, probably in M'Murdo Bay. From here in the beginning of the southern summer, September 1902, sledge parties were sent out. One of these visited Mount Terror, travelling along the mysterious ice barrier, which, it would seem, though fed from the land-ice, is afloat, a discovery of much significance. But, so far as our present information goes, the most important geographical work accomplished by the expedition was that carried out by the party led by Captain Scott himself. Somewhere about Mounts Erebus and Terror, it may be to the east or to the west, the coast is not continuous, as shown on our maps, but broken, giving access to what may be a gulf or a wide fjord. The sledge party, so far as can be made out, traversed this inlet on the ice as far as 82° 17′ S., where they reached land and were able to trace the inlet three degrees further, with great mountains in between. It is important to know whether the inlet goes further south and completely separates Victoria Land from the great glaciated land to the west. That we have here a great land mass, possibly of continental dimensions, and, it may be, broken into by gulfs or fjords, there can be little doubt.

Captain Scott has thus in a comparatively short time made additions to our knowledge of the greatest unknown area of the globe to be compared in extent and importance with those of his great predecessor Sir James Ross. The scientific observations and the natural history collections promise to be of not less value. Evidently no land animals have been met with, and we should have been glad to know whether any

fossils are included in the geological specimens. This we shall, doubtless, know in a short time, when the full reports are received. It is evident that, much as has been done, quite as much remains to be done in order that our knowledge of this region may be rounded off. We may hope that the Scottish and other expeditions now at work in the field will fill up some of these gaps.

German Antarctic Expedition.

Following upon the news of the British expedition, there has come news of one division of the German expedition. A telegram, received in Berlin on April 17, stated that on the previous day the steamer *Stassfurt*, of the German Australian Steamship Company, reached Sydney with three members out of the party of four which were left on the island of Kerguelen, with the object of carrying out a year's magnetic and meteorological observations there. One of the party, Dr. Enzensperger, died on the island on February 2 of beri-beri, while another member of the party, Dr. Werth, the geologist, has also been seriously ill, and will be detained in hospital in Sydney. It would appear that illness has also overtaken another member of the party. The news, coming so soon after the tale of hardship suffered by the members of the *Discovery*, has created a painful impression. The sufferings of the members of the Kerguelen party are the more unfortunate in view of the fact that its members were not engaged in actual exploring work, which must always carry a strong element of danger, but were established in permanent quarters, intended to shelter the party for a year.

The last news of the German expedition, previous to that which has now been received, was that the scientific station on Kerguelen island had been safely established, and that the *Gauss* had sailed for the practically unknown regions to the south on January 31 of last year. This news was made known by a German steamer which touched at the island early in April of last year, so that twelve months ago there was apparently nothing seriously wrong with the scientific party stationed on the island. It is presumed, however, that the long winter months which followed must have tried them severely. There is scarcely likely to have been a shortage of provisions, though, after the experience of the British expedition, no confident opinion can be expressed on this point. All arrangements had, however, been made for the continuation of systematic scientific investigation until the end of last February. After that date the party was to be prepared to leave the island as soon as called upon to do so. It is quite uncertain when news will be received of the main expedition under Dr. Von Drygalski. When the vessel left Kerguelen island, between fourteen and fifteen months ago, she was fully provisioned for two and a half years, and it was not anticipated that those on board would experience any want in this direction for some months after that period had expired. But Dr. Von Drygalski's instructions were to return to civilisation at the latest in June of next year, no matter what the work accomplished by the expedition had been. Should nothing have been heard of the *Gauss* before June 1, 1904, the question of a

relief ship was then to be taken into consideration. It would seem, however, that the action of those responsible for the British expedition in sending out a relief ship after the *Discovery* had been absent only one year has stirred the German Government to greater activity in this matter, for the latest information is that a relief ship is to be despatched in search of the *Gauss* if nothing is heard of her by June of this year.

THE NEW ZOOGEOGRAPHY.

Dr. A. E. Ortmann, in a recent paper,[1] discusses the aims of the modern zoogeographer. He points out that the method which is chiefly associated with the name of Dr. A. R. Wallace had for its main aim the division of the earth's surface into regions, which should indicate the general distribution of animals over the surface. But owing to the difference between the means of distribution at the disposal of the various groups of animals, it was found that the zoogeographical regions could not be constructed to cover the whole of the animal kingdom, and Wallace himself definitely restricted his regions to Vertebrates, especially birds and mammals. Again, while the existing distribution of the higher Vertebrates, and therefore the zoogeographical regions, correspond roughly speaking to the physical features of the earth's surface at the present time, there are certain anomalies of distribution which cannot be accounted for by the existing physical features. If this be true of birds and mammals, which are geologically of recent origin, much more is it true when the distribution of older groups is considered. Again, Wallace's zoogeographical work was based upon the theory of the permanency of the great ocean basins and continents, which of course emphasises the importance of the present main physical features of the globe by giving them great antiquity. The balance of modern opinion is, however, against the doctrine of the permanency of the continents, and there are many signs that a new conception of the aim of zoogeography is growing up. Ortmann pronounces it impossible to draw up a completely satisfactory scheme of the present distribution of animals, and would definitely exclude this as the chief aim of the zoogeographer. He sums up the tendencies of recent workers by saying that their common aim is to trace the gradual evolution of animal distribution from its beginning in the past to the present, and therefore to study especially the changes which have occurred in the distribution of land and water over the surface of the globe from the earliest times to the present. Zoogeography is thus intimately bound up alike with Historical Geology and with Physical Geography. But this conception of the aims and methods of the science does not exclude the construction of regions, it only gives this a subordinate position in the zoogeographer's work.

Dr. Ortmann then proceeds to carry out his own principles by a

[1] *Proceedings of the American Philosophical Society*, XLI. (1902), pp. 267-400.

detailed discussion of the distribution of Freshwater Decapod Crustaceans, that is freshwater prawns, crayfish, crabs, and similar forms. We cannot here follow the technical details of the study, but the general conclusions are of great interest. In the first place, it is to be noticed that these forms possess no special means of dispersal. All the types discussed are true freshwater animals, incapable of crossing the ocean by their own exertions. Similarly they are truly aquatic animals, in the majority of cases, and the total absence of water is always fatal to them. From the nature of the life-history also it seems improbable that young have any means of distribution denied to the parents. It follows from these facts that where the same forms exist in two regions now separated by ocean, we must conclude that these two were formerly connected by land. On these principles, Dr. Ortmann argues that the distribution of the types studied by him proves the connection at one period of the following continents:—North-east Asia and North-west America across Behring Sea; East Asia and Australia; South Asia and Madagascar and Africa; New Zealand and Australia; Australia and New Zealand and South America; the West Indies and Central and South America; South America and Africa. These connections may be studied in order. The evidence for the connection of Asia and America, by way of Behring Straits, is conclusive, and is not founded alone on the distribution of crayfishes, but the distribution of these enables us, by the aid of geology, to fix approximately the limits in time of the connection. It seems to have been established in Mid-Cretaceous times and continued up to the end of Tertiary times. As regards the connection between Australia and Southern Asia, the evidence is incomplete and conflicting; but it would seem that South-east Asia was connected with Australia in the Jurassic, and probably also in the beginning of the Cretaceous period. In the Upper Cretaceous, the two continents were sharply separated, and the separation continued possibly up to the Eocene. At this date the connection was at least partially re-established, but it was of a very changing character, a fact which is expressed in the great complexity of the animal distribution. These changing and unstable conditions apparently persisted throughout the whole of the Tertiary.

Almost as complex are the relations between Africa and India. Ortmann supports the view of the former existence of a continent of Lemuria, that is of a land-mass connecting Madagascar to India. He believes that during the Jurassic and Lower Cretaceous periods this land-mass formed a peninsula jutting out from Africa, India being then unconnected with what is now Asia. In the Middle and Upper Cretaceous this peninsula became connected with South-east Asia, so that there was free communication between Asia and Africa: this connection, however, only lasted till Eocene times, when India became an island, separated by ocean alike from South-east Asia and from the remnant of Lemuria (Madagascar). At a later period, the strait separating India from Asia disappeared, and India became permanently part of Asia. Meanwhile the south-western parts of Lemuria remained still connected with Africa, in the form of a peninsula. During the Oligocene, or beginning of the Miocene, the connection with Africa was severed,

and the island of Madagascar was thus formed. It will be noticed that according to this interpretation, the connection of Madagascar with India was severed before that between Madagascar and Africa. This is contrary to the views of some other authors, *e.g.* Lydekker.

The evidence from the distribution of the Freshwater Decapods is too incomplete to form the basis of definite conclusions as to a connection between New Zealand and Australia; but it is probable, on other grounds, that a connection existed by way of New Caledonia and New Guinea, and that it was interrupted at the beginning of the Eocene. The relations between Australia and South America seem to be very complex. It is probable that during the Mesozoic era Australia was connected with Antarctica, and this connection was broken at the end of the era, or at least at the beginning of the Tertiary. Whether or not South America was similarly united to Antarctica throughout the Mesozoic era is uncertain, but such a connection is at least probable at the end of Mesozoic time, and especially during the Eocene. During the Cretaceous period the extreme south of South America (southern Patagonia and Chili) was connected by land with Antarctica, but was separated from the Brazilian land-mass. During the Eocene, the elevation of the Cordilleras brought about a connection between the Brazilian land-mass and the southern parts of South America, so that the former was then connected with Antarctica.

As regards the history of the development of the Central American and West Indian region, the author is of opinion that the distribution of the Freshwater Decapods justifies the following conclusions. During the Mesozoic period, especially in Cretaceous and Jurassic times, Central America, the West Indies, and the northern margin of South America formed a continental mass (the Antillean continent) which was bounded by sea on the north and south. At the end of the Cretaceous period this continent broke up, the chief factor in its destruction being the formation of the Caribbean Sea. Up till the Eocene period parts of this continental mass, consisting of the Great Antilles and parts of present Central America, probably persisted as a unit. At the end of the Eocene period, and during Oligocene and Miocene times, the connection between the Great Antilles and the mainland was severed, but it was re-established at the end of Tertiary times, and finally destroyed in the recent period.

The distribution of Freshwater Decapods, no less than that of some other animals, suggests a connection between Africa and South America. Ortmann believes that in Jurassic and at the beginning of Cretaceous times a continent stretched across the Atlantic Ocean, and connected Africa both with the Northern and the Southern (Brazilian) region of South America. In the middle of the Cretaceous period the South Atlantic was formed, and a little later a branch of this ocean extended into what is now the valley of the Amazon, separating the southern part of the Brazilian mass from the northern (Guiana); but Guiana remained connected with Africa, and the land-bridge so formed probably persisted until the beginning of the Tertiary epoch, and was represented by a chain of islands so late as the Oligocene period.

The changes which the American continent as a whole has undergone are numerous and complex. It may be said to have originally consisted of three parts:—North America, the nucleus being in the east; the Antillean continent, consisting of the West Indies and Central America; and finally the old Brazilian land-mass. To the existing continent of South America a fourth part has been added, the Chilian-Fuegian coast range, originally, as indicated above, a part of the Antarctic continent. During the Lower Cretaceous, North America was separated from Central America, which then formed an independent continental mass. During the Upper Cretaceous, North America became divided into an eastern and western portion, and the western was connected with Central America. In the beginning of the Tertiary period, the eastern part of North America became united with the western while the latter retained its connection with the northern part of Central America. The latter was at this time divided into two parts by the formation of the Caribbean Sea, which communicated with the Pacific Ocean across Nicaragua and Panama, so that a part of Central America belonged to North America and a part to South America. During the Lower Cretaceous period Central America was bounded to the south by sea, but in the later Cretaceous it became connected with Guiana and so with Africa (see above), but was separated from the Brazilian land-mass by the interoceanic communication across the Amazon valley. In the early Tertiaries, Central America became united with the Brazilian land-mass, and later the isthmian region became land, so that North America and northern Central America became united with southern Central America and South America. The relations of South America are indicated by the above, but may be again briefly detailed for the sake of clearness. In the Lower Cretaceous and earlier, South America consisted of the Brazilian land-mass, which was connected with Africa till the middle of Cretaceous times, but became an island in Upper Cretaceous times by the formation of the connection between the Pacific and the Atlantic Oceans across the valley of the Amazon. At the end of the Cretaceous and the beginning of the Tertiary, by the elevation of the Cordilleras, the Brazilian Continent became connected with Antarctica, and at the same period it became united with southern Central America, and later with northern Central America and North America. At this date also (Mid-Tertiary), South America became separated from Antarctica.

Ortmann sums up his final results as to the changes which the land-masses of the globe have undergone in the following way:—In the Lower Cretaceous period four continental masses existed. These were (1) the Sino-Australian continent, consisting of Eastern Asia, the Indo-Malaysian Archipelago, and Australia, which was continued to Antarctica; (2) the Nearctic Continent, consisting of a large part of present North America, and extending probably across Greenland to the Scandinavian mass of Europe; (3) Antillea, formed by Central America (see above); (4) a continent to which v. Ihering's name of Archhelenis may be given, which comprised the Brazilian land-mass and tropical Africa, with the Lemurian peninsula. All these continents

were isolated from one another. In addition to them there were a number of islands, especially in the region which is now Europe.

In the Upper Cretaceous the following changes had taken place :— The Sino-Australian continent became divided into a Sinic (Asiatic) and an Australian portion. The former became united to the western part of Nearctica across the Behring Sea. The western part of Nearctica further became separated from the eastern, and united with Antillea. The Brazilian Continent became separated from Africa, and the Lemurian bridge became united with the Sinic continent. The final result of these changes was to produce a ring of land of irregular shape round the earth, generally speaking in the region of the Equator, but curving far to the north in the region of the Pacific. To this ring of land the name of Mesozonia may be given. Separate from Mesozonia in Upper Cretaceous times were the following continental masses :—A portion of Nearctica, diminished in size by the union of its western part with Mesozonia; a region called by v. Ihering Archiplata, comprising a part of Brazil, and Archinotis or the continent formed by the union of Australia and Antarctica. The existence of the ring-shaped continent Mesozonia in Upper Cretaceous times is of great importance to the marine zoogeographer, because it led to the formation of two sharply separated types of marine animals, the faunas now known as the Atlantic and Indo-Pacific. The present Atlantic type is descended from the forms which lived to the north of Mesozonia, the present Indo-Pacific type from the forms which lived to the south.

In Lower Tertiary times the following changes occurred :—The ring formed by Mesozonia was interrupted at three places—between Guiana and Africa, in Central America, between Africa and south-east Asia. The last interruption was a double one, the Lemurian bridge being destroyed between Madagascar and India, and India being disconnected from the Sinic land. Again, the southern part of Antillea became connected with Archiplata, which again was itself united with Antarctica, while Antarctica became disconnected from Australia. The result was to produce five isolated continental masses. The first of these is the Sino-Nearctic continent, which consists of the whole of North America, including perhaps the Scandinavian mass in Europe, the northern parts of Central America, and Eastern Asia (Sinic land). Second, there was Tertiary Africa, including the present continent, with the addition of Madagascar and Arabia. The third continent was very small, and consisted of the Indian Island. Australia, in much its present form, constituted the fourth continent; while the Antarctic region, united with South America, formed a great land-mass, to which the name of Neonotis is given by the author.

By the Upper Tertiary period considerable changes had taken place. First, the Sino-Nearctic continent became greatly enlarged, uniting with the island of India, with Africa, with the European Archipelago, and with Scandinavia, while the Nearctic region of the continent became connected in the region of Panama with South America (Neonotis). At the same time Madagascar became cut off from Africa, and Antarctica from South America. The result was that at this period there was

an enormous land-mass, comprising almost all the land in the Old and New World, while as separate land-masses we have Australia, Madagascar, and Antarctica, the last practically barren of life, and therefore of little interest to the zoogeographer. The enormous land-mass described above is of great importance in regard to questions of distribution, for it is owing to its existence that the distribution of many continental forms of life has become confused.

In recent times the most important change which has occurred has been the separation of North America from Asia and from Europe.

Ortmann admits that many of the above statements must be regarded as merely provisional; but he maintains that they at least illustrate the point of view which the student of geographical distribution should take, the aim which should guide his studies, this aim being definitely to study the evolution of existing conditions, and not merely to attempt to depict them in a scheme.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting in April.

On the 16th April, in Edinburgh, Mr. H. M. Cadell of Grange, B.Sc., F.R.S.E., addressed the Society on "The Development of the Nile Valley, Past and Future." The Chair was taken by Mr. Paul Rottenburg, LL.D., Chairman of the Glasgow Branch. Mr. Cadell's paper appears in the current number of the *Magazine*.

GEOGRAPHICAL NOTES.

EUROPE.

Fall of Dust in Britain.—On February 22-23 last, falls of dust were observed in various parts of the British area, as well as on the continent, and the suggestion was widely made at the time that the dust was due to the West Indian eruptions, but, according to *Nature*, there is now sufficient evidence to show that this was not the case, and the following explanation of the fall is given. The meteorological logs from various ships show that since the middle of December immense quantities of sand have been borne by the African harmattan wind over the Gulf of Guinea and out on the Atlantic to about 30° W. longitude. At first the phenomenon was limited to the tropical region, but in February, when we had such a remarkably persistent southerly to south-westerly wind in the British Isles, the north-east trade was displaced by a south-easterly to south-westerly breeze, at least down to the latitude of 13 N. The dust was, therefore, carried northward by this current, and there are a number of records of falls in various latitudes. On February 21, the day before the fall in Europe, a fine, light reddish dust was deposited on a ship in 10° N., 23½ W., the dust coming up from south-south-west or south-west.

Study of Plant Distribution.—In connection with the papers which we have published recently on the study of Plant Associations it is of interest to note a

paper on methods of botanical survey by Dr. W. G. Smith which appeared in *The Naturalist* for January. Dr. Smith recommends that those desirous of recording plant associations should choose a definite area where the vegetation is fairly uniform, as for example a wood, a portion of a moor, or some swamp, and after studying the plants of the region in detail, arrange the information acquired under the three heads of 1, Topography; 2, Flora; 3, Biology. The Topography includes all details about the station itself. The following are factors likely to influence the vegetation, and therefore to be recorded:—(*a*) Altitude above the sea, approximate slope, and exposure to north, south, etc. (*b*) Geology and soil: the recognised name of the geological formation, the character of the rock, the dip of the strata, and the mode of weathering of the rock into soil; in this work the aid of geological co-workers could be profitably called in. Notes on the soil should include (*a*) the texture and character of the soil and sub-soil, (*b*) the state of the soil as regards moisture, whether always wet or periodically dry, and whether drained or not. Special attention should be given to the relation of the soil to the underlying rock, whether the soil is immediately derived from it, or whether the rock has become covered up by peat, glacial deposits, or recent deposits. (*c*) Climate: including the temperature at different times of the year; rainfall and its distribution throughout the year, as well as dew, fog, or other atmospheric moisture. Where water is present in the selected area, its temperature should be noted as frequently as possible.

(2) The Flora or record of all the species found on the area is intended to show the constitution of the plant association; which species are dominant, subdominant, and dependent; also which plants are (*a*) characteristic of the particular association; (*b*) common, *i.e.* species which are abundant, but not confined to this association; (*c*) occasional or intruders from other associations. The final list can only be arrived at after a series of visits.

(3) The Biology includes notes on the adaptations of the various plants to their environment, while remarks too long to include in the floral lists would also find a place here. The biological details could not be attempted fully for every species found, and it is suggested that only characteristic plants be thus dealt with. There is a wide scope for observations on even the commonest plants, and this part of the survey should on no account be neglected. The botanist who has followed recent work will here have the advantage, but it is believed that with some guidance even a beginner would soon be able to record the life of some one plant.

Dr. Smith then goes on to point out the numerous uses to which results of this kind can be put if carefully kept.

For example, in the first place there is in such a series of records of associations the basis of a map of the vegetation, and of a more complete survey than has as yet been attempted. The relation of vegetation to altitude is rendered evident in a way which admits of rapid comparison. Again, the influence of climate may be traced from the maps by the meteorologist or geographer who has some knowledge of common plants, and the method renders the maps also of use to the geologist. Generally, it may be said that maps constructed on the basis of such a survey would be of value not only to geographers, but also to all the different specialists for whom the distribution of vegetation is directly or indirectly of importance.

ASIA.

The New Vegetation of Krakatao.—Mr. W. Botting Hemsley gives in *Nature* an interesting summary of the progress of the new vegetation of Krakatao. It is

within a few months of twenty years since the great eruption took place which absolutely killed all life in the island of Krakatao. About three years later, Dr. Treub visited the island and examined the beginnings of a new vegetation, the results of which were recorded in 1888. He found that the first vegetable settlers on the covering of pumice-stone, lava and ash were microscopic algæ belonging to the Cyanophyceæ. These organisms covered the surface with a slimy layer, which acted as a decomposing agent, and created a suitable substratum for ferns, of which about a dozen species were already abundant in 1886. Dr. Treub also observed a few individuals of fifteen species of flowering plants, most of which had sprung from drift-seeds.

In the spring of 1897, a party of botanists visited the island, and Dr. O. Penzig has published the results of their investigations and observations, from which we learn that sixty-two species of vascular plants were observed on Krakatao and the neighbouring islets, Lang and Verlaten. Fifty of these colonists are flowering plants, representing twenty-one natural orders, and it seems highly probable that they all reached the island independently of man. Classifying these fifty-three species according to the assumed means by which their seeds were conveyed to the islands, 7·54 per cent. were possibly carried by birds, 32·07 per cent. were probably wind-borne, and 60·39 per cent. were almost certainly cast up by the waves of the sea. No additional species of fern appears to have established itself in the islands between 1886 and 1897. This is inexplicable, because the region is rich in ferns, the spores of which, one would suppose, would be brought by winds in abundance. Apart from ferns, the probable "æolophilous" element consists of eight Compositæ, six grasses and four orchids. After passing the strand belt of vegetation, which is by far the most numerous in species, dense thickets of Phragmites, Saccharum and Gymnothrix were encountered. The interior and higher part of Krakatao is still much less covered with vegetation, ferns largely predominating. Conspicuous and relatively common amongst the flowering plants was Spathiglottis plicata, a terrestrial orchid. The other orchids are Vanda Sulingi, Arundina speciosa, and a species of Phajus. Krakatao is about twenty miles distant from both Java and Sumatra, and the most interesting question suggested by the new vegetation is, How far does it afford a solution of the problem of the origin of the vegetation of much more remote islands which have more than a littoral or coral island flora?

Progress of Navigation in China.—The Paris journal *Questions Diplomatiques et Coloniales* (15 March 1903), publishes the following statistical tables:—

Rank of the different Powers in the navigation of the Yang-tse.

Nations.	1898. Millions of Tons.	Per cent.	1899. Millions of Tons.	Per cent.	1900. Millions of Tons.	Per cent.	1901. Millions of Tons.	Per cent.
Britain, . .	12·28	61·5	13·45	59	14·30	55	15·73	51·2
Germany, .	0·60	3	0·57	2·5	2·62	10·1	5·36	17·5
China, . .	5·32	26·6	6·29	27·5	5·90	22·7	5·26	17·1
Japan, . .	0·98	5	1·58	6·9	2·27	8·7	3·07	10
United States, .	0·17	0·9	0·23	1	0·28	1·1	0·50	1·6
Russia, . .	0·12	0·6	0·20	0·9	0·15	0·6	0·19	0·6
Other Powers, .	0·51	2·4	0·51	2·2	0·48	1·8	0·58	2
Totals, .	19·98	100	22·83	100	26·0	100	30·69	100

Increase in the tonnage of each Power on the Yang-tse from 1898 *to* 1901.

Nations.	Increase in Millions of Tons.	Per cent. of Increase.
Germany, . .	4·76	793
Britain, . . .	3·45	28
Japan, . . .	2·09	204
United States, . .	0·33	200
Russia, . . .	0·07	60
Other Powers, . .	0·07	14
China, . . .	0·06	−1

Rank of the different Powers in the navigation of the Treaty Ports of Northern China.

Nations.	1898. Millions of Tons.	Per cent.	1901. Millions of Tons.	Per cent.
Britain, . . .	2·06	45·5	2·94	47·2
Japan, . . .	0·48	10·6	1·60	25·7
Germany, . . .	0·33	7·3	1·04	16·7
Russia, . . .	0·06	1·3	0·21	3·3
United States, . .	0·02	0·4	0·20	3·2
Norway, . . .	0·17	3·8	0·08	1·3
China, . . .	1·39	30·7	0·06	1·0
Other Countries, .	0·02	0·4	0·10	1·6
Totals, . .	4·53	100	6·23	100

Dr. Sven Hedin's Scientific Results.—All geographers will be delighted to learn that the publication of the scientific results of Dr. Sven Hedin's last great journey in Central Asia, in a manner worthy of their importance, is now assured. During the three years he was engaged in the exploration of Chinese Turkestan and Tibet Dr. Hedin collected a vast mass of material relating to the physical geography of the regions traversed, to the scanty population which the country supports, and to the conditions of life, widely different from those existing at the present day, which prevailed 2000 years ago in areas that are now mere wastes of sand. No adequate summary of the facts observed, and no exhaustive report on the collections formed, could be incorporated in any narrative of the expedition intended to appeal to the general public. The 6,500 miles of country covered by Dr. Hedin were mapped in no fewer than 1,149 sheets, the position of 113 points being fixed by astronomical observation. The character of the country was further illustrated by sketches from the pen and brush of the Swedish explorer, who is an artist of no little ability, and by a large number of photographs, of which over 2000 were brought home. Geological, botanical, and zoological collections were gathered together, meteorological observations were taken, and a large number of Chinese manuscripts and objects of archæological interest were discovered among the ruins of the sand-buried villages which line the northern shore of the ancient Lob Nor; while it need scarcely be said that the manuscript notes taken by Dr. Hedin during his long journey bulk very large.

On the completion of the expedition, last year, it was generally felt that so rich a harvest of scientific results ought to be garnered in a befitting manner, and

rendered accessible to as many scientific bodies as possible throughout the world. But Dr. Hedin could not himself bear the expense of an undertaking which could scarcely be expected to prove remunerative from a financial point of view. Accordingly, he sought the support of the Swedish Riksdag, asking for a grant of 75,000 kroner (about £4170), to enable him to publish the scientific results of the expedition on the lines of a scheme of which particulars were given in the petition. This request has now been unanimously acceded to by the members of the Riksdag. The Swedish Government has long been noted for the liberal way in which it supported the exploration of the Arctic regions. Quite recently a considerable grant was made to a joint Russian and Swedish expedition engaged in the measurement of a degree on the island of Spitzbergen. But Sweden has a more or less direct interest in all that relates to the Arctic regions, especially as regards the lands and seas to the north of Europe, whereas she may be said to have no immediate interests in Central Asia. The grant to Dr. Hedin affords, therefore, very real evidence of the enthusiasm which prevails in Sweden for the advance of general knowledge, and is an instance of the generous assistance with which the representatives of the people are prepared to encourage enterprise on the part of Swedish men of science.

The publication of the fruits of Dr. Hedin's labours will, it is hoped, be completed in three years. The work will comprise an atlas of two large volumes, while a third volume will contain Dr. Hedin's report on the geography of the country. Further volumes will be devoted to the meteorological observations, the astronomical observations, the geological, botanical, and zoological collections, and the Chinese manuscripts and inscriptions. Most of the volumes will be placed in the hands of well-known Swedish experts; that dealing with the manuscripts will be prepared by Dr. Himly, of Wiesbaden, the well-known sinologist. Dr. Hedin himself, besides drawing up the geographical report, will, of course, be closely associated with the whole of the work, and especially will direct the preparation of the maps, which has been intrusted to Captain H. Byström, of the Lithographic Institute in Stockholm. It is gratifying to learn that it has been decided to publish the work in English.

AFRICA.

French Railways to the Niger.—It is announced that a railway has recently been started from the French territory of Konakry to reach the navigable part of the Niger. Starting from Konakry itself, the line had in March advanced a distance of about thirty-five miles, and on this engines and waggons were then running with construction materials. The line had been cleared for a further forty miles, and by October next it is expected to be completed and open for traffic to Kouria, or, roughly, 100 miles. For the construction of this a loan has been granted to the colony of 12,000,000 francs, and it is hoped that this will suffice for the 100 miles. The line is going a further 250 miles to Kourrousa, whence the Niger is navigable to Bamiko. To the last named place the French are building their railway from Kayes, a distance of some 300 miles. This is likely to be completed by the end of this year, and opened for general traffic early next year. Great results are anticipated from this line on account of the richness of the country through which it passes. Another French line is now projected from Dakar to Kayes. At present there is a line to the Senegal river, but that river is not always navigable. A line going to Kayes and joining the Kayes to the Bamiko line would give Dakar direct communication with the navigable Niger.

The Livingstone Memorial.—By the courtesy of the Royal Geographical Society of London we are enabled to reproduce the accompanying illustration of the Livingstone Memorial recently erected near the spot where the great explorer died. The monument is built of well-burnt bricks, which are thickly coated with

Livingstone Memorial.

cement, and the whole structure is so arranged as to offer no surface upon which the rain may lie, so that it is expected that the monument will prove durable. There will be a considerable balance over from the work, and it is proposed to spend this in the erection of a native hospital at Fort Jameson, the nearest European settlement to the place where Livingstone died.

Scientific Expedition to Africa.—Dr. T. Rubin, of Upsala, the leader of the scientific expedition which has been despatched to Africa by the British South

Africa Company, left England in March. He was accompanied by Dr. Stoehr, the medical officer. After conferring with Sir David Gill, the Astronomer-Royal at Cape Town, Dr. Rubin and the other members of the expedition, who will join him in South Africa, will leave for Chinde *en route* for Fort Jameson. He will then confer with the Administrator of North-East Rhodesia, and at once proceed to the work of the geodetic survey.

The Development of Southern Nigeria.—Sir Ralph Moor, the High Commissioner for Southern Nigeria, has just returned to England after eighteen months' absence, and has communicated to the press some interesting notes on the future of the country. He states that the recent fighting was the complement of the Aro expedition, and was directed against the outlying sections of the tribes who were still inimical to British rule, and who were averse to the opening of the roads to trade. Southern Nigeria differs from other parts of West Africa in that it is impossible to deal with one tribe as a whole. Every village and town, being complete in itself, and separated from others by primeval forests and dense bush, was at war with its neighbour, and so, while the people of one place might be subjugated this would not have the least effect upon the inhabitants of the next place. But the crushing of the Aros, who, as the great trading people of Southern Nigeria, had the *entrée* into all the villages and towns, has had a great effect.

Although the Aros have been subjugated, the various sections of the Ibo people inhabiting the territory between the Cross river and the Niger, of whom the Aros were a part, were still warring with one another, and would allow no one but an Aro to enter their territory. It was to restore order among these people and in other tribes that the recent patrols were undertaken. These were largely in the nature of police work, in order to ensure the establishment of the government, and were entirely successful. Roads have been opened, and all tolls have been stopped. There are no circumstances that would lead one to suppose that a big expedition will be necessary in the future, though small expeditions and police patrolling will be necessary throughout the entire area. The only tribes that have not been dealt with live between the Cross and Benue. Here there are large Hausa settlements, together with a sprinkling of cannibals.

As regards the changes which have recently taken place, a judicial system has been established, and is having a great effect on the people. Natives who all their lives have been accustomed to settling their differences by force, by "trial by ordeal," and by rites of the most terrible description, involving every year the loss of many hundreds of lives, now crowd into the Government and native Courts. The country has been so divided up that a Court of Justice is within ten or twelve miles of every native home, so that he can go to the judicial officer for advice, and return to his home the same day. There are also some sixty native Courts, whose decisions are given under the supervision of the Government. In every case there is an appeal to the Supreme Court. Native Councils, too, have been established at various centres, where the chiefs manage their own affairs under the supervision of district officers.

To fully appreciate the benefits of British rule a visit to the once notorious centre of Bendi will be useful. This town, which was formerly an enormous slave market, where thousands of human beings were bought and sold every year, and the great centre of Fetishism, is still a great commercial centre. The market is as large and as busy as ever, but not a single slave is to be bought. All forms of Fetish are dying out. Hundreds of natives died every year as the result of frightful ordeals; but these have been done away with. Slavery in all its shapes has been abolished, and the native communities have been consolidated in their

old form of houses, all who formerly were in the position of slaves being placed in the situation of members of houses with the responsibilities and privileges attached thereto by native law and custom. The taxation, which, under the old system, amounted to twenty-five per cent., has already been reduced to five per cent. A system of education has been organised throughout the territories, and is working well. Schools are being established by the Government and the chiefs, assisted by commercial firms. At Benin City there are eighty boys in regular attendance, and the attendance at other centres is good. At Bonny £5000 is being spent on school buildings, and £10,000 on the erection of a high school building at Calabar.

As regards railway and other communication it is hoped that this year a further extent of waterway, 150 miles in length, will be opened for traffic. The actual construction of railway is for the moment in abeyance, but for strategical and development purposes every attention is being given to the subject. Active construction cannot take place until the value of the country has been more or less determined or particular points defined, on which it would pay to build railways. But a general scheme has been drawn up which will preserve the French and German frontiers, and also open up the country. By this scheme one line, starting from Old Calabar, would go over the Cross and Benue rivers, and through the Bautchi to Kuka, on Lake Chad. This would provide for the development and transport of the East and North-East Frontier. The system from Lagos would cross the Niger through Zaria to Kano, with a branch to Sokoto. This would develop the centre and western areas, and provide transport for the North-West Frontier. The two systems would be linked up by a branch line going from Kano and joining the Kuka line at Bautchi.

As regards commerce it is anticipated that a great stride in development will shortly be made by the establishment of branches of commercial firms on the waterways of the interior, which will bring exporters in direct touch with producers. This has been rendered practicable by the act of the Government in establishing effective control not only on such waterways, but in their hinterlands. A system of steam transport will naturally follow, and supersede on larger waterways the present system of transport by native canoes, which is slow and cumbersome. The present native middleman will be driven further afield, and producers generally will benefit also. An increase in the volume of produce for export will result.

The Cotton Question.—An article under this heading in *Questions Diplomatiques et Coloniales* describes, after referring to similar associations in Germany and England, the Colonial Cotton Association recently founded in Paris. The object of this association is to set on foot in the French colonies, especially in those parts of French Western Africa which border on Upper Dahomey and the banks of the Niger, scientific and practical investigations, with a view to determining the ground most favourable for the production of cotton, and the species most suitable to it and commercially the most useful. Such species might be obtained by either introducing and acclimatising Egyptian and American cotton, or by selecting and improving the indigenous cotton found in the wild state but unsuitable, in its present condition, for the European markets. To attain this object the Colonial Cotton Association proposes to send out expeditions and subsidise colonists already acquainted with the circumstances and people of the country,—it does not profess to be itself contemplating the exploiting of agricultural or commercial interests. In addition to the two points mentioned, the association proposes to examine the questions of native labour and of the conditions of

transport. As to the latter, the necessary railways are already in process of completion, and thus the important question is merely whether the rate of transport will be sufficiently low. This is one of the points to be carefully considered by the new association.

The Blue Nile.—The American expedition which left England in January with the object of exploring the whole course of the Blue Nile arrived at Jibutil on Wednesday, March 27th, and left for Harrar, where it has arrived. The expedition consists of Mr. W. N. M'Millan, of St. Louis; his secretary, Mr. Morgan Brown; and a servant named Marlowe, both the last-named being English. Mr. M'Millan is proceeding to Addis Abeba, from which place he and Colonel Harrington, the British Resident, will start on a thousand-mile journey on the Blue Nile, for the purpose of ascertaining the practicability of using the river as a trade route.

Uniform Time in South Africa.—In connection with the note on this subject in our last issue (p. 202), it is of interest to notice that the uniform time has been adopted by all the South African Governments with the exception of German South-West Africa.

AMERICA.

Geography in the University of Chicago.—The University of Chicago has established a Department of Geography, and Professor Rollin D. Salisbury, of the Department of Geology, has been placed at its head. The arrangement between the Departments of Geology and Geography is such that Professor Salisbury retains his connection with the former as heretofore, at the same time that he assumes the headship of the latter. The close connection of the two departments appears from the fact that Professor Salisbury will also act as head of the Department of Geology when Professor Chamberlin is not in residence, and Professor Chamberlin will act as head of the Department of Geography in Professor Salisbury's absence.

The Department of Geology has heretofore offered courses, both elementary and advanced, in Physical Geography and elementary courses in Meteorology. Other courses of a geographic character have been offered by other departments, notably Geographic Botany by the Department of Botany, Zoögeography by the Department of Zoölogy, and Commercial Geography by the Department of Political Economy. Those courses will continue to be given, as heretofore, by these several departments, except that Meteorology will be under the auspices of the new department. The new department will not duplicate the geographic courses already given, but will, at the outset, provide courses which supplement those already established. The immediate aim of the new department will be to occupy the ground intermediate between Geology and Climatology on the one hand, and History, Sociology, Political Economy and Biology on the other. The courses offered at the outset will be those for which, within this field, there is greatest demand.

John Paul Goode, Ph.D., in charge of the work of Geography in the Wharton School in the University of Pennsylvania, has accepted an Assistant Professorship in the Department of Geography, and will begin his work the second term of the summer quarter (July 27, 1903). No other appointment will be made this year. During his first year Dr. Goode will be in residence during the second term of the summer quarter, and during the autumn and spring quarters. The courses which he will give during the first year will include courses on the Economic Geography

of (1) North America, (2) Europe, and (3) Tropical Countries. The central theme of these courses will be the influence of the physiography, the climate, and the natural resources of these lands on their settlement, development, and present commercial and industrial status. Research courses will also be offered for advanced students.

The geographic work of the University during the coming year will include the following courses, in addition to those given in the Department of Geography :—

I. In the *Department of Geology.*—(1) An elementary course in Physiography, each quarter ; (2) A local field and laboratory course, first term, summer quarter ; (3) Two field courses in Geology and Geography about Devil's Lake and the Dells of the Wisconsin, in Wisconsin, one month each, commencing June 18 and July 27 respectively ; (4) A course in advanced Physiography, autumn quarter ; (5) A field course (for advanced students) in the Wasatch mountains of Utah and vicinity.

Other courses which, while primarily geological, are fundamental to the proper conception of the evolution of the present geography of the continents, will also be given in this department.

II. In the *Department of Zoölogy.*—Courses in Zoögeography, summer and spring quarters.

III. In the *Department of Botany.*—(1) An elementary course in Plant Geography (time not announced) ; (2) An elementary course in Ecology, summer and spring quarters ; (3) Elementary and advanced courses in Field Botany, summer and spring quarters ; (4) Advanced courses in Geographic Botany, winter quarter ; and (5) A course in Physiographic Ecology, summer and spring quarters.

IV. In the *Department of Political Economy.*—Courses in Commercial Geography, summer, autumn, and winter quarters.

School of Education.—In addition to the foregoing, courses in Geography will be given by Miss Baber in the School of Education (the Normal Department of the University). These courses are planned primarily with reference to the needs of teachers in the grades. Miss Baber will also conduct a field course of one month's duration during the second term of the summer quarter, beginning July 27th.

POLAR

Ice in Arctic Seas.—The Danish Meteorological Institute has published its valuable annual statement relating to the state of the ice in the Arctic Seas in 1902, with charts for each month, from March to August. Some of the general results show that the winter ice broke up very late, that the Polar ice lay nearer Asia and Europe than usual, and that the number of icebergs carried from Greenland to the temperate seas was notably smaller than usual. Also that the summer of 1902 has been rough and unsettled in nearly all Arctic and sub-Arctic regions, northerly and easterly winds predominating in Atlantic and Arctic seas. No safe conclusions for 1903 can be drawn from the limited data available, but conditions appear favourable for the passage of a considerable number of icebergs east of Labrador and Newfoundland.—*Nature.*

North Polar Exploration.—Mr. A. Fiala is to be the leader of the new North Pole expedition, which Mr. Ziegler, is dispatching to the Arctic. Mr. Fiala was

one of the members of the Baldwin-Ziegler expedition, which concluded its work last year. He arrived in England at the end of March from the United States, and left at once for Norway to join the steamer *America* (formerly the Dundee whaler *Eskimo*), which has been lying at Tromsoe since the return of the expedition last year. Captain Edward Coffin, who has been appointed to the command of the *America*, and the crew have just arrived in Norway from New York. Mr. Fiala states that all the members of the expedition will be Americans. There will be some thirty-five in all, a large number of whom will be American whalers. On reaching Tromsoe, Mr. Fiala will make the necessary preparations on board the *America*, and leaving the navigating staff in charge will return to the United States next month. He will then proceed to Norway with the scientific staff in time to allow the expedition finally to leave for the North Polar regions in June. Provisions and stores for two years will be taken, and on leaving Tromsoe the *America* will steam direct for Archangel, where she will embark fresh supplies. Mr. Fiala states that the main idea of the expedition is to make a forced march to the Pole from a base of supplies.

GENERAL.

Scottish Meteorological Society. — The half-yearly general meeting of the Scottish Meteorological Society was held in Dowell's Rooms, George Street, Edinburgh, on March 25, Sir John Murray, K.C.B., in the chair. The chairman, in moving the adoption of the report by the Council, said it was almost in all respects satisfactory. It was especially satisfactory to find that the necessary funds had been obtained to keep the observatories at the top of Ben Nevis and in Fort William at work for other two years until the report of the Parliamentary Committee was made. He felt sure one reason of the great success of that was the activity of their hon. secretary, Sir Arthur Mitchell, and they owed him a very great debt of gratitude for his efforts in this direction. The one unsatisfactory phase of the report was that Sir Arthur Mitchell should have resigned his official connection with the Society. When they remembered that he was one of the founders of the Society, that he took a very active part in securing their acting secretary, Dr. Buchan, and when they remembered all he had done for the Society, it was not without a certain amount of regret that they found that he had considered it his duty to himself to resign his position as hon. secretary. Sir Arthur had been a man of great activity, and had done so much for the capital of Scotland and for intellectual progress throughout the country that he felt it was not necessary for him to dwell upon this aspect of his resignation, but they hoped that he would be long spared as a member of the Council and would give them the benefit of his experience in connection with the Society. Mr. R. T. Omond, Sir Arthur Mitchell's successor, seconded, and Dr. Buchan supported the motion which was unanimously adopted. Dr. Buchan communicated a paper on the meteorology of Christmas Island. On this island which, he said, lay between Australia and Asia, and had a population of about nine hundred, there was virtually little variation in the barometric pressure throughout the whole months of the year, the difference for a whole year being 3-10ths of an inch. Another feature of the climate of the island was the remarkable uniformity throughout the year of the temperature. The highest temperature was 92 degrees, and the lowest 67 degrees. Observations extending over 560 days showed that in one year no rain fell on Christmas Island for 200 days leaving 165 days with some rain. Out of that year 274 days had less than 1-10th of an inch of rainfall. It was a very dry climate for a great part of the year, and even in the months when the rainfall was

heavy there occurred periods of a week or a little longer which were dry. There were no very prolonged periods of continuous heavy rain. Christmas Island was outside the cyclonic region of the Indian Ocean, but while they had no winds they were subject to rough seas. That might possibly be connected with storms in the Indian Ocean further to the north-west. The skies were clear. In the dry season about a third only of the sky was covered with cloud and in the wet season only half, showing a climate much drier and brighter than in this country. Mr. A. Watt next read a paper on "The Climate of Palestine in Ancient and Modern Times," in which he gave a general description of the climate of modern Palestine based chiefly on observations received since 1896 from Dr. Alexander Paterson, medical missionary at Hebron, and on the publications of the Palestine exploration Fund. Comparison was made from point to point with the Biblical records and the opinion was expressed that in its general features the climate had not changed within historic times. The weather lore of the Bible was in every way appropriate to the average weather of to-day. Reference was made to the fact that rainfall measurements were made in Palestine in the second century A.D. At that time and to-day the distribution of the rainfall during the winter months was much the same as in ancient times, the gentle "early," and "latter," rains were well marked, as were the heavy rains of midwinter. The actual amount of rainfall could not, in spite of popular opinion to the contrary, have been materially affected by the partial deforestation of the country. For certain scientific reasons it was probable that the amount had not greatly altered. It might also be fairly assumed that the ancient stone water-cisterns, which are scattered all over Palestine and are of undoubted antiquity, were constructed of such a size as to store all the rain that normally fell in the rainy season, and the officers of the Exploration Fund had noted that those cisterns which had not fallen into disrepair were in many years filled to overflowing, suggesting that the demands on their storage capacity were not less than when they were made. The undoubted deterioration in fertility of the country could be explained without supposing any change of climate. The Palestine of to-day had the misfortune to be part of the Turkish Empire, agricultural methods were of the most primitive sort, and the oppression of the tax-gatherer crushed all enterprise. The authors were cordially thanked for their contributions.

COMMERCIAL GEOGRAPHY.

The Fisheries of Canada.—The Canadian Department of Marine and Fisheries have just issued their thirty-fifth annual report for 1902, comprising the fishery statistics for the preceding year. The total value of the fish and fish products amounted to 25,737,153 dols., or about £5,281,000, being four million dollars greater than the value in 1900, and three millions greater than in any preceding year. There were 78,290 fishermen employed, using 5,837,677 fathoms of nets, 1231 vessels, and 38,186 boats, the value of boats and gear being nearly eleven and a half million dollars. Besides these, 15,315 persons were engaged in the lobster industry, for which there exist 855 canning establishments. The salmon canning industry in British Columbia gave employment to 18,941 persons, over fifty-nine million cans being preserved; while the sealing fleet consisted of 39 schooners, 139 boats, and 226 canoes, manned by 900 sailors and hunters. The most valuable product of the fisheries was salmon, which were valued at 7,221,387 dols., or nearly a million and a half sterling—an increase of 3,328,000 dols. over the previous year. The value of cod was £828,917; lobsters, £666,081; herrings, £382,794; and mackerel, £281,640. None of the other

products, as haddocks, trout, sardines, halibut, etc., reached a million dollars in value. From the year 1869 to 1901 the value of the cod, salmon, lobsters, herring, and mackerel has aggregated £74,673,000, cod being by far the most important. With regard to the various provinces, Nova Scotia, as usual, heads the list in 1901 with an aggregate value of £1,640,000, but it is very closely followed by British Columbia. The vote for the fisheries service in the fiscal year ended 30th June 1902 amounted to £122,923, of which £34,944 was for the superintendence of fisheries—nine cruisers and three steam launches being employed—£32,820 for bounties to fishermen and fishing vessels, and £16,417 for fish-culture. For this latter work sixteen hatcheries were in operation in 1902 in various provinces, the total number of fry distributed reaching the enormous total of 271,401,000, comprising lobsters, salmon, lake whitefish, trout, black bass, etc. A hatchery for the artificial propagation of shad is to be erected. It is stated that the work of the United States Fish Commission with this fish has been so successful that the fishermen are now beginning to complain that the superabundance of their catches has so reduced prices as to make the fishing less profitable to them.

The New Australian Goldfields.—The Agent-General for South Australia has received information from his Government in Adelaide concerning the more recent discoveries about twenty-three miles from the Altunga Cyanide Works. The Government geologist (Mr. H. Y. L. Brown) has reported generally favourably on the gold claims and leases at Winnecke's depôt. He does not consider the Reward claim of great importance, owing to the small percentage of auriferous ore contained in the quartz and to the absence of payable gold in the large masses of solid quartz outcropping on the property. He recommends sinking and driving across the veins to prove whether the gold goes down or not. As regards some of the other adjoining properties the geologist is more favourably impressed. He reports in favour of the Coorong block on the east of Paddy's Goose, of the junction on the north of the Coorong block, of the Coronation to the west of the above claims, and of the Melba, which is west of the Coronation, and also of the Black Eagle; in each case he considers the prospects of the reefs being payable to be good. Mr. Brown recommends other claims and neighbouring districts as promising and well worthy of further prospecting. He summarises his report by adding that some of the gold discoveries at Winnecke's promise to be of considerable importance when properly opened up. There is every reason for expecting that a payable gold-reefing field will be developed in the course of time.

Department of Land-Records and Agriculture, United Provinces of Agra and Oudh.—The second forecast of the wheat crop for 1902-1903, published by this Department, states that the season, like last year's, has been unusually dry. November and December were entirely rainless, but irrigation was resorted to on a large scale; and the rain in the last week of January, which was pretty general, greatly benefited the unirrigated crop. Some damage from frost has been reported from the western districts, but it was slight. So far no injury from hail or rust has been reported from any part of the province. In the Allahabad, Benares, and Gorakhpur divisions and in Oudh, the wheat crop should be very good—barring accidents, at least a full normal crop. In the western divisions of Meerut, Agra, and Rohilkhand the reports are not quite so favourable, and damage is attributed to white-ants and frost, but, barring accidents, the crop should be about 90 per cent. of the normal. This relates to condition up to the 20th February. As to the second forecast of the linseed and rapeseed crops of 1902-1903, the first winter rains fell in the last week of January, and generally benefited the rapeseed and linseed crops. Only a little damage from frost has been reported, and that

only from a few districts where the area under these crops is small. Harvesting was begun in March in the eastern districts, and very nearly a full normal outturn is expected for the province as a whole.

NEW BOOKS.

EUROPE.

Baedeker's Northern Italy. Including Leghorn, Florence, Ravenna, and Routes through Switzerland and Austria. With 30 Maps and 39 Plans. Twelfth remodelled edition. Pp. lxiv + 563. Leipsig: Karl Baedeker, 1903. *Price M.* 8.

Baedeker's Southern Italy. Including Sicily and Excursions to the Lipari Islands, Malta, Sardinia, Tunis, and Corfu. With 27 Maps and 24 Plans. Fourteenth revised edition. Pp. xlix + 444. Leipsig: Karl Baedeker, 1903. *Price M.* 6.

In a new edition of Baedeker one always expects some improvements and additions, and in these two Italian volumes we are not disappointed. There are several new maps, including a very pretty one of Capri. The general revision to date appears to have been careful and thorough. The pegamoid waterproof cloth, now adopted for binding of the handbooks, is a great improvement both as regards appearance and durability.

Baedeker's Russia. Manuel du Voyageur avec 19 Cartes et 32 Plans. Troisième édition refondue et mise à jour. Pp. l + 476. Leipzig: Karl Baedeker, 1902. *Price M.* 15.

Failing an English edition, we are glad to have a new French edition of *Baedeker's Russia.* Every year Russia is becoming more frequented by the more intelligent travellers, while Mr. Freshfield has introduced the mountaineer to the fascinations of the Caucasus. Although a small volume for such a large country, yet all routes and places of interest to the tourist are described in Baedeker's usual systematic and thorough manner, together with all the information necessary for a traveller in the country. The volume is confined to European Russia, but we would suggest that if Mr. Baedeker brings out an English edition, he should include the Trans-Siberian Railway Route as an excursion.

Baedeker's Southern France. Including Corsica. Fourth edition. With 30 Maps, 36 Plans, and a Panorama. Pp. xxvii + 548. Leipzig: Karl Baedeker, 1902. *Price M.* 9.

The one defect of this handbook, from an English point of view, is the limited treatment accorded to the Riviera. Considering its importance from a tourist's point of view, 38 pages out of 548 is scant allowance. From Baedeker we expect much and we are therefore disappointed, when, in an important map like that of the Pyrenees, we do not find the same high standard of hill-drawing and engraving which we are accustomed to in his Swiss maps, nevertheless for Southern France as a whole one could not have a better guide.

Adria. Neue Skizzen von der. Von San Marco bis San Giusto. Josef Stradner. Pp. 176. Verlag "Leykam" in Graz. 1902.

Adria, which gives its name to the Adriatic, was once on the shores of that sea, now it is an inland town. These sketches are however descriptive of the

district of Adria, which includes the plain along the northern shores of the Adriatic and its cities.

The Tale of a Tour in Macedonia. By C. F. Abbott. London: Edward Arnold, 1903. *Price* 14*s.*

There are many signs in the political horizon of the Near East that another Macedonian question is likely to come to the front in a more or less short time. We apprehend that a good many of our readers have but hazy notions of what the Macedonian question really is, and to them we recommend this book as an excellent introduction to the study of a difficult problem. In Macedonia there are Jews, Greeks, Servians, Sclavs, Bulgarians, Albanians, Wallacks, and Gipsies, all fighting continually with each other, and all under the pitiless rule of Constantinople. The inevitable result is chronic misery and seething discontent, which periodically reach the boiling point, *i.e.* insurrection, and then there is a Macedonian question. Usually the Turks solve it in their own characteristic and effectual way by wholesale massacres and similar strong measures, trusting with very good reason that the mutual jealousy and rivalry of the European powers will prevent any active interference with methods of repression sanctioned by precedent and enjoined by the creed of Islam. Sometimes, however, some awkward details find their way to the Christian press, and all Europe is scandalised. The Powers are shocked, or profess to be so, and by some even remonstrances are made. The Sublime Porte knows them to be but *vox et prætereа nihil*, and after prolonged and skilful procrastination promises reformation. There the matter ends; the Powers are glad to be rid of a thorny problem; something else occurs and demands general attention, and Macedonia is forgotten. How this is possible can be to a certain extent gathered from the very interesting volume now before us. The author does not talk politics, but his account of what he saw and heard during his tour in the south-eastern parts of Macedonia enables us to picture to ourselves the distraught and miserable condition of the inhabitants under the ruthless rule of the Turks, and the apparent hopelessness of any effort to raise them to better things. The primary object of the writer was to study the folklore of Macedonia, and judging from the present volume his forthcoming work on the folklore will be well worthy of attention. He has the pen of a ready writer, a keen sense of humour, great powers of observation and description, a fairly impartial judgment, and a due sense of proportion. The book has some very good illustrations, and a useful map.

The Land of the Black Mountain. By Reginald Wyon and Gerald Prance. London: Methuen and Co., 1903. *Price* 6*s.*

In this agreeably written work two Englishmen describe a six months' tour in the eastern half of Montenegro, during which they saw the more interesting parts of these Highlands and everywhere met with much courtesy and kindness. Indeed the tour must have been exceedingly interesting and enjoyable as well as occasionally exciting. The country is inhabited by a warlike race, who not long ago succeeded in wresting their independence from the Turks by a struggle the results of which will take generations to efface. It is hemmed in on three sides by Austria, of which the Montenegrins have a profound and on the whole a well-founded distrust. On the fourth side, *i.e.* the east, are the Albanians, who it would appear from this book are the hereditary and implacable enemies of the Montenegrins, and on the frontier they shoot each other at sight. The Montenegrins are brave, loyal,

patriotic, hospitable, and generous, but they have not yet reached that point of civilisation where women are recognised as the equals of men. "As the social scale descends, so does the position of woman. In the lowest classes she is still not much more than a beast of burden, given to man to ease his lot. She carries heavy burdens to market while her lord rides; she may not walk at his side, but a few paces to the rear; neither may she sit at table with strange men. The kiss with which men salute each other is not allowed to her, and she must kiss the hand only of the man. Likewise she must rise to her feet when men pass by, and in some districts, should she meet a man on the way, she must stop and remain meekly standing at the side of the path; also she must leave the room backwards." As to the honesty of the Montenegrins, we are assured that thieving and robbery are practically unknown. "Should a man drop a case of banknotes on the road, *the law says* that the finder shall pick it up and place it on the nearest stone, so that the loser has but to retrace his steps, glancing at the wayside stones. *This law is invariably followed.*" After this we are not surprised when we come to a description of a jail at Cetinje, the capital, to find that the building had no wall around it. "Each man (*i.e.* each prisoner) brings his own bedding and nicknacks, with which he decorates the wall above his bed and makes the place as much like home as possible. Loss of liberty is the only real punishment, and even that is not carried to an excess. . . . The prisoners have comparatively free intercourse with the outside world, plenty to eat, and on festivals wine and even spirits and a dance with their friends outside. . . . In the central prison at Podgorica, if a prisoner escapes, the rest of the criminals are sent out to catch him. Very often they find him, and never has a prisoner abused this privilege, all punctually returning by a given date." On the other hand the barbarous custom of vendetta flourishes here quite as much as in Corsica, and in this book we have many gruesome stories in connection with it. The writers wax enthusiastic over the weird and magnificent scenery through which they passed, and were charmed with the reception they everywhere met with. Their tour was not altogether destitute of dangers of various descriptions, and these dangers lose nothing in the telling. Altogether the book is well worthy of perusal, and we must add it is illustrated with many beautiful photographs, and has a useful map, by means of which the movements of the writers can easily be followed.

AFRICA.

With Macdonald in Uganda. By Major Hubert H. Austin, C.M.G., D.S.O., R.E. London: Edward Arnold, 1903. *Price* 15*s*.

To those of our readers who heard Major Austin's extremely interesting lecture in May last on his journey from Cairo to Lake Rudolf and Mombasa, this new work by him on Colonel Macdonald's explorations in Uganda will be very welcome. The period to which it refers is from the middle of 1897 to the spring of 1899, and the scene of the explorations is the territory of Uganda and what lies to the north-east, *i.e.* between Uganda on the south-west, Latuka on the north, and Lake Rudolf on the north-east. The work of exploration had unavoidably to be postponed owing to the unexpected mutiny of the Sudanese troops, the repression of which was complicated and delayed by the assistance and support given to the mutineers by the rebel chief Mwanga, who had been allowed to escape from German territory. They were also assisted by the Wanyoro from the west of Lake Albert Nyanza. So many contradictory accounts have been given of the origin, progress, and suppression of the Sudanese rebellion that we are glad to have this one from the competent hands of one who took a prominent part

in the operations. He thoroughly and successfully vindicates Colonel Macdonald from the aspersions which were cast on his capacity as an officer and administrator, and the gravity and seriousness of the mutiny may be gauged from the fact that in its suppression the losses to the British included 7 Europeans killed and 5 wounded, and 835 killed and wounded of the Government troops and their allies. When the mutiny had been more or less suppressed, the work of exploration was resumed, or rather commenced, and the main body marched from Kampala on the Victoria Nyanza to Mbai and Save on the western slopes of Mount Elgon. Thence they proceeded north, passing on the east of Mount Dabasien, and then marched through Manimani on to Ziti and Gule. From here Macdonald pushed on to Latuka, where he was hospitably received by the Sultan of the country, who invited him to visit his capital, Tarangole. At Tarangole Macdonald had to decide whether he was to return whence he came or to make for Lado on the Nile to the north-east; but the impossibility of making certain of food supplies for his men practically settled the question, and there was no alternative but to return to Save. It was on this return journey that Captain Kirkpatrick of the Leinster Regiment lost his life, having been treacherously murdered by a number of the Nakwai tribe while ascending a hill for geographical information. The geographical results of this column's expedition were that the districts between Save and Tarangole were successfully mapped.

The second column was under the command of Major Austin, and its object was the exploration of the western shore of Lake Rudolf. The march of this column was along the Turkwell river, across the Chemorongi Mountains, and again along the Turkwell to Ngamatak, where they reached the country of the Turkana, a tall, powerful, athletic, but treacherous tribe, and thence they marched due west to Lake Rudolf, still skirting the right bank of the Turkwell, to the point where it enters the lake. Then they turned again to the north, and passing between Mount Lubur and the lake, they marched to Murle on the north of the lake, leaving the Lorusia Mountains on the west, the approximate position of which Major Austin succeeded in fixing. At Murle the expedition experienced the same fate as that of the main body at Tarangole. The food supply failed. The Abyssinians had devastated the whole region, and the inhabitants were starving; thus there was nothing for it but to return to Save. In the course of their retreat the column was repeatedly in great danger from hunger and the attacks of the treacherous Turkana. The geographical results of Major Austin's expedition were that 850 miles were marched and surveyed. Excellent service was also rendered by a third column under Lieutenant Hanbury Tracy, which acted from the base at Save, collected supplies, and kept open the lines of communication with the two exploring columns. The Rudolf column was the first to reach the base at Save, and in consequence of what he heard there as to the possibility or indeed probability that Macdonald might have more trouble with the Sudanese mutineers, Major Austin decided to proceed to his relief. So he started with a small column which fell in with Macdonald near Bukora, whence the combined bodies returned to Mount Elgon. Here it was ascertained that it was necessary to bring the exploration expeditions to a close as their supplies and their means of purchase were nearly exhausted. The column was accordingly divided into two, one commanded by Major Austin which started first, and the other by Colonel Macdonald. Both columns arrived at Mumia's within a day of each other at the end of the year 1898. From there to Mombasa, on the coast, where the column was disbanded, the march was over practically well-known ground.

Even from the foregoing brief and bald outline of the ground covered by

Macdonald's expedition, the reader will gather that Major Austin's volume is replete with a variety of interesting matter. It appeals to the military reader, to the geographer, to the explorer, and to the ethnologist. The style is graphic and lucid; there is no wearisome repetition, and the subjects are treated with a due sense of proportion. We gather much interesting information regarding the tribes through whose territories the expeditions passed. Major Austin is a keen and successful sportsman, so the fauna of these hitherto unexplored regions afford many opportunities of enlivening the narrative with tales of hunting and sport. Throughout the volume we are impressed with the writer's loyalty to and admiration of his chief, Colonel Macdonald, and the unmistakable zest and pleasure he has in recording and bearing witness to the gallantry, zeal, and ability of his comrades. In conclusion we must add that the book is equipped with an excellent map, with the aid of which the reader has no difficulty in following the movements of the expeditions.

Précis of Information concerning the Uganda Protectorate. Compiled in the Intelligence Division, War Office, by Brevet-Major E. M. Woodward. London: His Majesty's Stationery Office, 1902. *Price* 5*s.* 6*d.*

This useful little handbook contains a full account of the Physical Geography, early History, Natural Resources, Means of Communication, and Administration of the Protectorate, and is illustrated by a map in four sections of Uganda, a map of the routes, and a sketch-map showing the provinces and districts. It contains references to the works already published upon the Protectorate, which will enable those interested to pursue the subject further.

GENERAL.

Précis de Géographie économique. Par MM. Marcel Dubois, Professeur de Géographie coloniale à la Faculté des Lettres de l'Université de Paris, et J. G. Kergomard, Professeur agrégé d'Histoire et de Géographie au Lycée de Nantes. Deuxième édition revue et corrigée avec la collaboration de M. Louis Laffitte, Professeur à l'Ecole supérieure de commerce de Nantes. One volume. 8vo. Pp. 833. *Price* 8 *francs.* Paris: Masson et Cie., 1903.

A second edition of this standard work is welcome. The fact that the first edition is already exhausted is evidence that in France it supplies an educational want. When one realises that France rejoices in professors of "Colonial Geography" who write books on "Economic Geography," her keenness on colonial development can be better understood. Britain, with her vast colonies, has no professor of British Colonial Geography and no work on Commercial Geography at all equal to this text-book. When are we to wake up? In a text-book on economic geography, two requirements are essential: first, a thorough and systematic statement of the resources and the geographical conditions of a country, in other words, its economic statistics, its physical and political geography; second, an intelligent critical commentary on these facts leading up to a statement of the principles determining the geographical development of commerce. Professors Dubois and Kergomard amply fulfil these requirements in their valuable text-book, which is the most exhaustive educational work on the subject we have yet seen. The authors praise the administration of the British Empire as a marvel of wisdom and skill, and remark: "How many other colonial powers might take a lesson from this clever policy!" If this commendation should lead to self-satisfaction on our part, the result would be mischievous. We are already too prone to rely on a continuance of our good fortune in the past, for-

getting that with keen, world-wide competition the conditions of British trade are now entirely altered. In the future, if we are even to hold our own, we must sharpen our wits and develop our resources in a somewhat more scientific manner. The one defect of this book is the absence of maps and illustrations, which, if not given in the text, should form an accompanying atlas.

Handbook of Instructions for Collectors. Issued by the British Museum (Natural History). London: Printed by order of the Trustees of the British Museum, 1902.

This small handbook consists of a series of pamphlets written by the different experts of the British Museum on the best methods of preserving Natural History specimens. The pamphlets can be obtained separately, but are here bound up together for the convenience of travellers and others who may be desirous of undertaking more than one branch of collecting. The directions are throughout briefly put and very much to the point, and should be of great use not only to persons desirous of collecting for the British Museum, but to amateurs in all branches of Natural Science. A considerable number of simple figures have been used to illustrate the more important points discussed.

POLAR.

Report on the Collections of Natural History made in the Antarctic Regions during the Voyage of the "Southern Cross." London: Printed by order of the Trustees of the British Museum, 1902.

Magnetic and Meteorological Observations made by the "Southern Cross" Antarctic Expedition. London: Published by the Royal Society of London, 1902.

These two reports sum up the main results of the *Southern Cross* Expedition. As regards the Natural History collections, the results have suffered greatly from the death of the zoologist, Mr. Nicolai Hanson, during the voyage of the expedition. A very large collection of seals was made, but unfortunately the tubs in which they were sent home were not labelled, and no list of the collection has been found. Again, the large collection of invertebrates has been found to have suffered considerably, owing to the methods of preservation adopted, which in many cases have proved inadequate. The account of the penguins observed by the expedition is of great general interest, but much of the material has already appeared in Mr. Borchgrevink's *First on the Antarctic Continent*, and Mr. Bernacchi's *To the South Polar Regions*. The volume is beautifully illustrated, and will be of great value as a book of reference, and also in the working out of the collections of the other expeditions.

The Magnetic results have been reduced by Dr. Charles Chree, and the Meteorological ones by Mr. W. N. Shaw.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

The Tale of a Tour in Macedonia. By G. F. Abbott. Pp. xi+343. *Price* 14*s. net.* Demy 8vo. London: Edward Arnold, 1903.

The Land of the Black Mountain. The Adventures of two Englishmen in Montenegro. By R. Wyon and G. Prance. Pp. xviii+300. *Price* 6*s.* Crown 8vo. London: Methuen and Co., 1903.

Sibéria et Californi, Notes de voyage et de Séjour. Janvier 1899-Décembre 1903. Par Albert Bordeaux. *Price* 4 *fr.* Paris: Librairie Plon-Nourrit et Cie, 1903.

Abrégé de Géologie. Par A. de Lapparent. Pp. xvi + 424. Paris: Masson et Cie, Editeurs, 1903.

Unknown Mexico. A Record of Five Years' Exploration among the Tribes of the Western Sierra Madre, in the Tierra Caliente of Tepic and Jalisco, and among the Tarascos of Michoacan. By Carl Lumholtz, M.A. With numerous Illustrations. In 2 vols. 8vo. £2, 10*s. net.* London: Macmillan and Co., 1903.

Voyages and Travels. Mainly of the Seventeenth Century. With an Introduction by C. Raymond Beazley, Fellow of Merton. 2 vols. Demy 8vo. *Price* 4*s. each.* London: Archibald Constable and Co., 1903.

Descriptive Geographies from Original Sources. Europe, Asia, and Africa. Selected and edited by F. D. and A. J. Herbertson. Crown 8vo. 2*s.* 6*d. each.* A. and C. Black, 1903.

The Beaten Track in Italy. A Guide to the Cities and Districts of Italy usually visited by English-speaking travellers. With a new Plan of Rome. Pp. xv + 120. London: Henry Gaze and Sons, 1903.

The Nile Reservoir Dam at Assuân and After. By Sir William Willcocks, K.C.M.G. 2nd edition. Pp. xii + 35. London: E. and F. N. Spon, Limited, 1903.

Wirtschaftsgeographische Studien des Grossbritannien. Von Stefan D. Popescu. Pp. viii + 178. Leipzig: Druck von Oswald Schmidt, 1903.

Also the following Reports, etc. :—

Bradshaw's Through Routes to the Capitals of the World and Overland Guide to India, Persia, and the Far East. A Handbook of Indian, Colonial, and Foreign Travel. Pp. xlvii + 452. London: Henry Blacklock and Co., 1903.

Handbook of Cyprus for 1903. Compiled by Sir J. T. Hutchinson, M.A., and Claude Delaval Cobham, C.M.G. Pp. xii + 99. London: Waterlow and Sons, 1903.

Time, Tide, and Distances. A Handy Book of reference for the Shipowner Underwriter, or Traveller. By Commander J. M'Kirdy, R.N.R. Pp. 41. London: J. D. Potter, 1903.

Magnetic and Meteorological Observations made by the "Southern Cross" Antarctic Expedition under the direction of C. E. Borchgrevink. Pp. 112. Demy 4to. Published by the Royal Society of London.

Marine Biological Association of the West of Scotland. Formerly the Millport Marine Biological Station. Annual Report for 1902. Pp. 48. Glasgow, 1903.

The Statesman's Year Book. Statistical and Historical Annual of the States of the World for the Year 1903. Edited by J. Scott Keltie, LL.D., with the assistance of J. P. A. Renwick, M.A., LL.B. Fortieth Annual Publication. London: Macmillan and Co., 1903.

Report on the Administration of the Civil and Military Station of Bangalore for the Year 1901-2. By the Hon. Lieut.-Colonel D. Robertson, C.S.I. Bangalore, 1902.

Report on the Administration of the Punjab and its Dependencies for 1902. *Price* 3*s.* Lahore, 1902.

Report on the Administration of the Bombay Presidency for the Year 1901-2. Bombay, 1903.

Précis of Information concerning the Uganda Protectorate. Compiled in the

Intelligence Division, War Office. By Brevet-Major E. M. Woodward. Pp. 159. *Price* 5*s.* 6*d.* With 6 Maps. Intelligence Division, War Office, 1902.

Kleines Orts-Lexikon von Osterreich. Von Dr. K. Peuker. Pp. iv + 35. Wien: Artaria and Co., 1903.

Transactions of the Highland and Agricultural Society of Scotland. Fifth Series, vol. xv. Edinburgh: William Blackwood, 1903.

United States Commission of Fish and Fisheries Commissions Report, 1901. Washington, 1902.

Annual Report of the Smithsonian Institution, 1900. U.S. National Museum, Washington City, U.S.A., 1902.

Bulletin of the United States Fish Commission. Vol. xxi., 1901. Washington, 1902.

United States Department of Agriculture. Report of the Chief of the Weather Bureau, 1901-2. Washington, 1902.

Report on the Administration of Coorg for the Year 1901-2. Mercara, 1902.

Memoirs of the American Museum of Natural History. Vol. v. Publications of the Jesup North Pacific Expedition. By Franz Boas and George Hunt. Washington, 1902.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 28th February 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas, Price 3*s.* each). *Forfarshire.*—Sheets xx. 9, 13; xxvii. 3, 9; xxviii. 15; xxxiv. 5, 11, 12; xxxv. 1; xxxix. 12; xl. 6, 9; liv. 10. *Hebrides* (*Inverness-shire*).—Sheets xiv. 5; xxvi. 9, 13; xxxvii. 16. *Island of Skye* (*Inverness-shire*).—Sheets iii. (15 and 11); iv. 2; vi. (3 and 7); xi. 2; xvii. 1, 5, 14; xxiii. 10; xxviii. 14, 15; xxix. 8; xxxiii. 16; xxxiv. 14; xxxv. 2, 11; xli. 13; xlv. 16; lvii. 4, 8, 12, 15, 16; lviii. 1, 5; lxiii. 4, 10. *Orkney.*—Sheets cxii. 1, 2, 6, 7; cxx. 8, 14; cxxiii. 5, 9 (10 and 11); cxxvi. 2, 3, 7.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Zetland.*—Sheets 42, 46, 47, 48, 69 (Price 2*s.* 6*d.* each). Sheets (57 and 57A), 58, 60, 63, 64, 66, 68 (Price 2*s.* each).

Quarter-Sheets. *Aberdeenshire.*—102 SE. (Price 1*s.*). With Contours:—*Aberdeenshire.*—1 SE.; 2 NW., 2 NE.; 5 SE.; 13 NE.; 103 NW., 103 SW. (Price 1*s.* each). *Forfarshire.*—25 SE.; 26 NW., 26 SW.; 32 NW., 32 SE.; 33 NW.; 37 NW., 37 NE.; 38 NW.; 42 SW.; 43 NW., 43 SW.; 44 NE., 44 SE.; 48 NW.; 50 NW. (Price 1*s.* each).

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st March 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas. Price 3*s.* each). *Forfarshire.*—Sheets xxvii. 12, 16; xxviii. 11; xxxiv. 4, 8; xxxv. 14; xl. 10; xli. 1, 5; liv. 1, 2, 5, 6, 9. *Island of Skye* (*Inverness-shire*).—Sheets iv. 9; ix. 5, 6, 7; xvii. 15; xxix. 4; xxx. 1, 15; xxxiii. 3; xxxiv. 13; xxxv. 10.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Island of Rum* (*Inverness-shire*).—Sheets 66, 67 (Price 2s. 6d. each). *Orkney.*—Sheets 70, 71, 72, (73A and 73), 76, 78 (78A and 83), 87, 91, 93 (Price 2s. each). *Zetland.*—Sheets 59, 62, 65, 67 (Price 2s. 6d. each).

Quarter-Sheets. *Forfarshire.*—7 NE. (7. SE. and 8 SW.) (Price 1s. each). With Contours:—*Aberdeenshire.*—1 NE.; 3 NW., 3 NE.; 9 NW. (Price 1s. each). *Forfarshire.*—32 NE.; 37 SW.; 38 SW., 38 SE.; 42 NE.; 43 NE., 43 SE.; 44 NW., 44 SW.; 49 NE. (Price 1s. each).

One-inch Parish Indexes.—Printed in colours, showing the six-inch maps. Sheets 59, 72, 82 (Price 1s. 6d. each). Printed in colours, showing the six-inch maps and quarter-sheets. Sheet 54 (Price 1s. 6d.). Printed in colours in two forms, one showing the 1 : 2500 scale maps, and the other the six-inch maps. Sheets 70, 74, 81, 90, 119 (Price 1s. 6d. each). Printed in colours in two forms, one showing the 1 : 2500 scale maps, and the other the six-inch maps and quarter-sheets. Sheets 61, 62, 63, 75 (Price 1s. 6d. each). Printed in colours in two forms, one showing the 1 : 2500 scale maps, and the other the six-inch quarter-sheets. Sheets 66, 97 (Price 1s. 6d. each).

Four-Mile Map, by Sheets, hill-shaded and printed in colours. Sheets 10, 11, 12, 13, 14, 15 (Price 1s. each).

Ten-Mile Map of Great Britain, with water printed in colour.—Sheets 1, 2, 3, 4, 5, 6, 7, 8 (Price 1s. each).

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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

PRIMITIVE MAN, AS REVEALED BY RECENT RESEARCHES IN THE CAVES NEAR MENTONE.

By Ralph Richardson, F.R.S.E., F.S.A.Scot.

The ancient philosopher who summed up human philosophy in the precept, "Man, know thyself," probably referred chiefly to the mental and moral attributes of Man. But modern philosophers have advanced the inquiry a stage further by insisting upon our knowledge of the Origin of Man. It is clear that this later development of the ancient inquiry depends upon no study of Metaphysics or Moral Philosophy, but only upon physical research, and in order to complete that research we must consult various sciences, such as Geology, Anthropology, Philology, and Archæology.

Admittedly the geological records of Man are extremely scanty. His appearance on our planet is comparatively so recent that he has not had time to become petrified in its rocks like other animated creatures. Yet we can trace him in a fossil state from a very remote antiquity, so remote as to make the most ancient historic record appear in comparison but a thing of yesterday.

From a geological point of view, Man made his appearance towards the end of the great Glacial Epoch, and his advent marked at once the latest and highest stage of animated beings. He was the companion of the Cave Bear, the Rhinoceros, and the Mammoth in the Caves which are still visible throughout Great Britain. He lived by the chase, and the ashes of his fires still strew the Caves he once tenanted. He was occasionally an Artist as well as a Sportsman, for cleverly executed sketches of the Mammoth and Reindeer attest not merely the Glacial Period in which he lived, but also the skill with which he could pourtray the creatures around him.

Attempts have been hazarded to determine where Man first made his

appearance. Philologists have swept the East from the sultry plains of Mesopotamia to the frozen wastes of Tartary in their efforts to locate the first residence of Man, but I am not aware that they have been successful. They have, however, discovered philological links which seem to imply that Man spread from one race or family over the whole world, and they have found that many of the roots of words which we use in daily conversation were handed down to us from immemorial ancestors, living we know not where, coming we know not whence.

In approaching the subject of Primitive Man, let us note that a great difference exists in dwellings, in implements, in ornaments—in a word, in culture—between the very earliest stage and the later stage of Primitive Man. The former stage has been termed the older Stone Age or Palæolithic Period, while the latter stage has been termed the newer Stone Age or Neolithic Period. It has been truly remarked, however, that Primitive Man's treatment of stones does not sufficiently indicate the enormous difference in his condition in these two periods respectively, and that our attention must be directed to many other aspects of his life before we can grasp the immensity of the separate changes in the culture then possessed by Man.

Palæolithic Man (the oldest representative of the human race) seems to have been a tattooed being, with shells or perforated teeth adorning his neck, slaying animals with rude implements of stone, horn, or bone, living either in Caves wrested from wild beasts or in open sheltered spots, such as in the valley of the Somme in the North of France, where the bones of Palæolithic Man are found intermingled with those of the Mammoth, Rhinoceros, Bison, Reindeer, Cave Lion, and Cave Hyæna.

In the Caverns of Cro Magnon in Perigord, a district of Western France, Palæolithic Man also dwelt, and there he showed his artistic faculty by drawing on ivory a spirited representation of his congener the Mammoth.[1] I mention this Cro Magnon variety of the early human race as it is particularly referred to in connection with the Caves near Mentone.

In his recent work on Uganda Sir Harry Johnston instances the Pygmies, a dwarf race of that region, as among the lowest representatives of mankind in features, intelligence, and physique. We must beware, however, of concluding from the physique of men, whether fossil or living, that they belong to the very lowest type of mankind. When the famous Neanderthal skull was brought to light near Düsseldorf in 1857, some savants declared that the "Missing link" had at last been discovered. Dr. Paul Topinard, Curator of the Museum of the Anthropological Society of Paris, stated that, although clearly human, the skull reminded him of that of the female gorilla.[2] But not only was this skull found to be much superior to that of the ape, but also it was discovered to bear a very close resemblance to that of the illustrious Scottish hero and king, Robert the Bruce.[3]

[1] Lyell's *Antiquity of Man* reproduces this sketch.

[2] *Anthropology*, "Contemporary Science Series, 1878," p. 437.

[3] *Man and the Glacial Period*. By Professor Wright. "International Scientific Series, 1892," p. 276.

The other human skulls of greatest antiquity yet discovered are those of Canstadt near Stuttgart, and of Spy near Liége, yet Professor Wright is of opinion that the men of the Neanderthal, Canstadt, and Spy were identical in type and probably in age. Thus we arrive at the conclusion that the most ancient fossil human skulls are similar to that of our King Robert the Bruce, who, according to Sir Walter Scott, "was generally accounted one of the best soldiers and wisest sovereigns of his time."[1] Sir Walter describes the discovery in his own day of the remains of the king during repairs on Dunfermline Abbey, when "they came to the skeleton of a tall man, and they knew it must be that of King Robert, both as he was known to have been buried in a winding-sheet of cloth of gold, of which many fragments were found about this skeleton, and also because the breast bone appeared to have been sawed through, in order to take out the heart," carried by the Douglas to Spain. Sir Walter likewise refers to the discovery beside the Bruce's skeleton of the king's "wasted skull, which once was the head that thought so wisely and boldly for his country's deliverance."

I propose in this paper to describe briefly discoveries of fossil Men which have been made near Mentone in recent years, and actually during the year 1902. These are, I believe, the latest, as they are certainly the most complete, evidences we have received of the physique of Primitive Man, and furnish us not merely (as in the previous cases cited) with details of his skull, but of his entire skeleton. They thus present features of unusual interest and importance.

The discoveries were made in Caves which are nine in number, and which, from iron infiltration having stained them red, are known as the "Rochers rouges." These Caves are situated on the Italian shore of the Mediterranean to the east of Mentone, and about a mile on the eastern side of the Italian frontier. In the Italian *patois* of the district the "Rochers rouges" are termed "Baoussé Roussé," or in Italian "Balzi Rossi" (Red Rocks), and are often so referred to by writers.

The Caves occur in Nummulitic limestone of Eocene age, in which veins of sulphate of lime appear, and are now situated at a considerable height above the present level of the Mediterranean. A celebrated Roman road, the Via Aurelia, once ran past them and formed the great passage along the sea-coast between Italy and Gaul. Fragments of that road are still visible.

I had the privilege of visiting the Caves during March 1902 in company with that experienced cave explorer and archæologist, the Rev. J. E. Somerville, the well-known Scottish clergyman of Mentone, who gave me the history of the researches and discoveries which have made the Mentone Caves so famous.

As long ago as 1786 the Geology of this district was investigated by De Saussure, the celebrated Alpine geologist, but Prince Florestan of Monaco seems to have been in 1846 the first to explore the contents of the Caves, some of which are situated on the Italian property of the

[1] *Tales of a Grandfather*, chap. xi.

Prince of Monaco, lying within the hamlet of Grimaldi (the Prince's family name) and Commune of Ventimiglia. The present Prince of Monaco, being devoted to science, continues the researches begun by his ancestor, and, as I shall explain presently, his efforts have lately been crowned with remarkable success.

While in 1858 M. Forel discovered within the Caves flint instruments, charcoal, and bones of animals (*Bos primigenius*, etc.), M. Rivière of Paris was the first writer to give to the Caves world-wide celebrity. This was due to his discovery in the so-called "4th Cavern" of a skeleton which became famous as the "Fossil Man of Mentone," and which he described in a paper read before the Académie des Sciences de Paris on 29th April 1872. The remarkable discovery announced in this paper sent Sir Charles Lyell to Paris to examine the skeleton, which had been deposited in the Jardin des Plantes there. It also sent the famous explorer of Kent's Cavern near Torquay, Wm. Pengelly, F.R.S., all the way to Mentone to examine the 4th Cavern for himself. Lyell's report will be found in his *Antiquity of Man*[1] and Pengelly's in the *Journal* of the London Institution.[2]

Let us, however, hear what the actual discoverer, M. Rivière, has to say upon the subject in the paper which he read at Paris and which has been referred to.[3] After describing how he found the human skeleton, which was 5 feet 9 or 10 inches high and all but perfect,[4] in "Le Caverne du Cavillon" or 4th Cavern, he states that "this skeleton presents no feature whatever which resembles the ape. The human skulls which have most analogy with it are those which have been found at Cro Magnon. He also remarked that the skull of the skeleton was "*très dolichocéphale, bombé au sommet*," that is, "very long headed, and arched on the top."

As M. Rivière and most authorities consider that the Cave Men of Mentone were contemporaneous with and similar to those of Cro Magnon, I may remark that it was in the Cavern of La Madeleine that was found, carved on ivory by a Cro Magnon Cave Man, the clever drawing of the Mammoth which then inhabited the district, being probably the earliest freehand drawing ever made by Man.[5]

Near the skeleton discovered by M. Rivière he found remains of the following animals:—

Carnivora.

Cave Bear (*Ursus spelæus*).
Cave Lion (*Felis spelæa*).
Common Bear (*Ursus arctos*).
Lynx (*Felis lynx*).
Wolf (*Canis lupus*), large.
Wild Cat (*Felis catus*).
Cave Hyena (*Hyæna spelæa*) above the skeleton.

[1] 11th edn. 1873, p. 113. [2] Vol. iii. 1873, No. 18.
[3] *Comptes Rendus de l'Académie des Sciences de Paris*, 29 Avril 1872.
[4] Lyell, *op. cit.*
[5] Figured in Lyell's *Antiquity of Man*, 1873.

Pachydermata.	Rhinoceros (*R. tichorhinus*).
	Horse (*Equus caballus*).
	Wild Boar (*Sus scrofa fossilis*).
Ruminantia.	Urus or Wild Bull (*Bos primigenius*).
	Elk (*Cervus alces*).
	Red Deer (*Cervus elaphus*).
	Canadian Stag or Wapiti (*Cervus Canadensis*).
	Corsican Stag (*Cervus Corsicanus*).
	Roebuck (*Cervus capreolus*).
	Chamois (*Antilope rupicapra*).
	Goat (*Capra primigenia*).

M. Rivière considers that the presence near and above the skeleton of the great *Felines*, *Ursus spelæus*, and Rhinoceros indicate the *Palæolithic* epoch during which the Man lived. Near the skeleton he found two flint knives, a deerhorn pin, and twenty-two perforated canine teeth of a deer—a primitive human necklace. The man, he thought, had evidently died during his sleep.

In 1873 M. Rivière discovered in the 6th Cavern another human skeleton of great size, being no less than nearly 2 metres or 6 feet $6\frac{3}{4}$ inches. His opinion was that the prehistoric people of the Mentone Caves were probably a very tall race. The Man found by Rivière in 1873 was like the Man found in 1872 buried in a "*foyer de cendres*" (a hearth of ashes), and was adorned with ornaments and surrounded by his weapons.

As I said before, Mr. Pengelly visited the 4th Cavern, which he found to be 260 feet above the sea-level. From his long experience of Kent's Cavern he was an expert in such researches, and his conclusion regarding the age during which the Man flourished whose skeleton Rivière exhumed in 1872 must be respectfully received. Pengelly states that he considered that this Man "verily belonged to the Palæolithic age, and probably, not certainly, to the unpolished Stone age."[1] He adds, "Not one single polished implement was found in the Cavern at all." Mr. Somerville, however, mentioned to me that a polished implement had been found beside Mammoth remains in one of the Caves and at a lower level than that at which human skeletons had been discovered.

Dr. Joseph Anderson has laid down that if Man is found associated with animals either now extinct or no longer indigenous, and if his implements are fashioned by chipping alone, then his remains may rightly be assigned to the earlier, or Palæolithic part of the Stone age.[2]

Applying this dictum to M. Rivière's finds, we are inclined to conclude that the skeletons he discovered belong either to the Palæolithic, or most ancient period of human life, or to a period between the Palæolithic and Neolithic, as suggested by Mr. Somerville.

A literary battle, however, of considerable warmth and duration has been waged around this assertion, one English archæologist, Mr. A. J. Evans,

[1] *Op. cit.* [2] Chambers's *Cyclopædia*, 1889 (Art. "Flint Implements").

arriving at the conclusion that, "though embedded in a Palæolithic stratum, the human remains in these Caves are of Neolithic date."[1] On the other hand, he considers the entire absence of pottery and polished implements, and of remains of domestic animals, a very remarkable phenomenon, and he is compelled to admit that we find "here an earlier Neolithic stratum than any of which we have authentic records." This conclusion gives weight to Mr. Somerville's suggestion that the skeletons mark a period betwixt the Palæolithic and Neolithic.

Another English writer, Mr. Vaughan Jennings, champions the Palæolithic age of the skeletons, and after stating that one skeleton is at least 7 feet high, he points out that the skulls here are stronger, thicker, and more definitely ridged than the Neolithic skulls found in such caves as occur at Finale Marina on the same coast-line. He continues: "The strong supra-orbital crests, the projecting occiput, wide facial angle, and powerful mandible are all features occurring in skulls of older periods than the Neolithic."[2]

A third English writer, Dr. W. Allan Sturge, considers that the Mentone Cave Men "were contemporary with the great extinct Mammals, were of almost gigantic size, and that they mark the evolution of Man from the Palæolithic to the Neolithic age. Driven from the North of Europe by extreme cold, Palæolithic Man would take refuge in the Rochers Rouges."[3]

Probably the leading French authority on the Caves near Mentone is Dr. R. Verneau, President of the Anthropological Society of Paris and Joint Editor of the French magazine *L'Anthropologie*. His first communication on the Caves appeared in the issue of that journal for September-October 1892, when he announced the discovery in 1892 in the "Barma Grande" or Great Cave, of skeletons of a very tall man, a woman, and a youth. All three wore necklaces of perforated teeth of the deer, and the man (who was 6 feet 5 inches high) had in his hand a very fine flint weapon. Dr. Verneau does not, in this paper, attribute Palæolithic antiquity to these finds; but he made subsequent researches, and in a pamphlet (published in English by M. Abbo,[4] the proprietor of the Barma Grande and the discoverer of the three skeletons) Dr. Verneau states that the Cave Men occupied "the Caves from the beginning of the Quaternary (or Glacial) epoch to the Neolithic age." He identifies them with the Cro Magnon race which, as the Cro Magnon sketch of it proves, peopled France during the Mammoth period. "That this race," he says, "lived at Baoussé-Roussé (Rochers Rouges) is certain from the evidence of the skeletons which present all its physical characteristics; from in-

[1] *Journal of Anthropological Institute*, May 1893.

[2] *Natural Science* for June 1892. Dr. Munro in his *Prehistoric Problems* (Edin. 1897) refers readers to the article by Dr. Colini of Rome in *Bull. di Palet. Ital.*, 1893, pp. 117 and 233, for a review of the whole series of explorations at the Rochers Rouges.

[3] *Riviera Nature Notes*. Manchester, 1898.

[4] Entitled, *The Men of the Barma Grande*: An account of the objects collected in the "Museum Prehistoricum," founded by Sir Thomas Hanbury. Translated from the French of Dr. R. Verneau. Fr. Abbo, publisher, Baoussé-Roussé, near Mentone, 1900. Sold at the Caves.

numerable implements bearing, so to speak, its trademark; and from its artistic productions."

During March 1902 I visited three of the Caves near Mentone, viz.:—

1st, The Grotte des Enfants, which is being explored by the Abbé de Villeneuve for the Prince of Monaco. Remarkable discoveries have quite recently been made in this Cave, as I shall afterwards explain. Its name is derived from two children's skeletons being discovered here by M. Rivière in 1874 and 1875.

2nd, A Cave, as yet unnamed and unexplored, into which Mr. Somerville and I let ourselves down with difficulty, and inspected with the aid of candles. We found it encrusted with stalactites and stalagmites, some of considerable size. No human relics have been discovered yet. This Cave is situated on an elevated position of the Rochers Rouges, higher than the railway line and lying to the north of it.

3rd, The Barma Grande, or Great Cave, over which I was shown by M. Abbo, junior, the son of the proprietor, and who spoke English. This is a huge Cavern situated 65 feet above the sea, and extending 53 feet in length by 13 feet in breadth, with a height of 65 feet. Facing the Mediterranean, this Cave would form to our primeval ancestors as pleasant a residence in Glacial times as a "full south" Riviera villa does to our friends in winter to-day. Entering the Cave, it was with no ordinary emotion that I perceived one of these ancestors reclining on the ground in his last sleep. Beside him lay a chaplet of shells with which his friends had affectionately adorned his head before burial. M. Abbo had left this skeleton undisturbed, so that I saw it exactly as it had been discovered by him on 12th January 1894. The skeleton was that of a man 6 feet high, and belonged to the same tall Cro Magnon race as the skeletons previously described.

During my visit to the Caves with Mr. Somerville, I asked him his opinion regarding the antiquity of the skeletons, as he had studied the Caves and their contents with great care and with perfect impartiality for the past fourteen years. He said he thought the Cave Men of this district belonged neither to the Palæolithic nor Neolithic age, but lived during the period between the two known as the Mesolithic. The Men were, in his opinion, of the Cro Magnon type which, according to Dr. Paul Topinard,[1] had long skulls, with high foreheads, broad and well developed above the superciliary ridges. The race was robust and of full stature, and represented the most ancient race of France, but, in Dr. Topinard's opinion, it was much later than the Canstadt type to which the Neanderthal and other skulls belonged.

Mr. Somerville stated to me that in the Caves near Mentone the Mammoth remains were found beneath the skeletons, but that a polished implement had been discovered beside the Mammoth remains, and he did not think it had dropped down from a higher layer, but that it furnished evidence that Man and the Mammoth existed contemporaneously here. This conclusion is strengthened by the Cro Magnon drawing of the Mammoth already referred to.

[1] *Op. cit. supra.*

Mr. Somerville further remarked that Reindeer remains had been found in the same layer as the skeletons, but that no pottery had been discovered.

Mr. Somerville considered that the Mentone Cave Men had been buried in a red earth brought here specially for the purpose. They were not (as Dr. Verneau suggests) cremated, but were buried after having been painted with ochre: and this ceremony, added to the ornaments they wore and the implements and weapons laid beside them, implied, to Mr. Somerville's mind, that the Men had been buried in preparation for a future state. As Dr. Robert Munro has pointed out, "The earliest evidence of religiosity shows itself in the inhumation of the dead body, accompanied by such objects as were supposed to be useful on the journey to the unseen world."[1]

With regard to the disposal of his dead by Primitive Man, Dr. Moriz Hoernes asserts[2] that cremation did not come into practice till after the later Stone age. The peculiar Burial earth and painting employed at the Rochers Rouges may have preserved the skeletons from decay.

Thanks to that wealthy and public-spirited Englishman, Sir Thomas Hanbury, whose splendid gardens of La Mortola constitute one of the "sights" of the district, Mr. Abbo, the proprietor, has been assisted in opening up the Barma Grande, at the entrance to which Sir Thomas has erected a handsome museum in which Prehistoric relics of the greatest value are stored and exhibited.

There is also a considerable collection of Prehistoric remains from the Caves in the Municipal Museum of Mentone, whose curator, M. Bonfils, showed me molars of Rhinoceros and Mammoth which he had discovered below the Tower of Grimaldi, not far from the Caves, while he also exhibited a large polished block of porphyry which he had found in the Barma Grande, and which he said had been used by the Cave Dwellers to remove the wrinkles from the skins of the animals with which they clothed themselves.

What inferences, then, are we to draw from the remains of these very ancient representatives of the human race which have been found within the Caves near Mentone? I think we may come to the following conclusions:—

1. The race of Men here belonged to the Cro Magnon type, and inhabited this district during a period when severe Glacial conditions obtained throughout Northern and Central Europe.
2. They were splendidly formed men, between six and seven feet in height, with well-developed skulls and bodies, and with no Simian racial indications.
3. They lived by the chase, and were able, by skill, courage, and the use of weapons, which they had fashioned with their own hands, to kill wild animals of formidable size, ferocity, and strength.
4. They had sufficient knowledge of art to be able to design in

[1] *Prehistoric Scotland*, 1899, p. 173. [2] *Primitive Man*, p. 11.

vigorous and truthful lines the animals around them, as proved by their drawings of the Mammoth and Reindeer.

5. They were fond of decorating themselves, and employed perforated shells and teeth and the vertebræ of fish as ornaments for their heads and necks. These Men were also the earliest Palæontologists, as some of their ornaments consisted of fossil shells obtained from beds in Switzerland hundreds of miles to the north of Mentone.
6. They painted their dead with ochre, and decorated them with the Prehistoric finery of the ornaments already mentioned, while implements or weapons were placed in their hands or laid by their side.
7. They buried their dead decently in red earth, specially brought for the purpose.
8. From the care they took to paint and decorate and bury and preserve their dead, and from the implements or weapons which they placed beside them, we may infer their belief in a future state in which they thought they would continue to lead the same existence as that which they had known here, and would live by the chase of wild animals, a belief common to the Red Indians of our own day. As Pope expressed it[1]:—

> "Lo, the poor Indian! whose untutored mind
> Sees God in clouds, or hears Him in the wind:
> . . . . .
> To be, contents his natural desire;
> He asks no angel's wing, no seraph's fire;
> But thinks, admitted to that equal sky,
> His faithful dog shall bear him company."

Such seem to be the conclusions we may reasonably arrive at from the discoveries of human remains made here by M. Rivière, M. Abbo, and others up to March 1902 when I visited the Caves. Other discoveries, however, have been made more recently by the Abbé de Villeneuve, who, as I said, was exploring the Grotte des Enfants on behalf of the Prince of Monaco. According to a paper communicated, on 21st April 1902, by Dr. Verneau to the *Académie des Sciences de Paris*,[2] the Abbé de Villeneuve had not merely discovered at a depth of about 23 feet (7·05 m.) a skeleton of a man, over 6 feet high (1·90 m.), of the Cro Magnon type already described, but also, about 2½ feet (0·70 m.) deeper, two skeletons which were decidedly of a Negroid type. One of these skeletons was that of an old woman (1·57 m.) and the other that of a youth (1·55 m.), both about 4½ feet high, and neither robust. From such specimens we cannot, of course, ascertain the height of a full-grown man of this Negroid type here. Remains of Deer, and especially of Hyæna, were found, but not those of Mammoth and Reindeer.

Dr. Verneau remarks that the discovery of human beings of a Negroid type in these Caves is quite new. Rude implements carved out

[1] *Essay on Man.*

[2] *Comptes Rendus*, No. 16 (21 April 1902).

of sandstone and limestone and rarely out of flint were found at the depth where the Negroid skeletons were discovered, and both Dr. Verneau and M. Cartailhac have no hesitation in pronouncing these implements Palæolithic. They consider the Negroid skeletons belonged to an earlier race than the Cro Magnon ones found in the Barma Grande.[1]

We thus infer that the Caves near Mentone were inhabited first by a Negroid and subsequently by a Cro Magnon race, the latter being probably driven south by increasing Glacial conditions, and displacing the Negroid race from the Caves which they had previously occupied. With the Cro Magnon race were also driven south the Mammoth and Reindeer which inhabited this Mediterranean coast contemporaneously with Man during a portion of the Glacial Period. It does not follow, however, that the ice covered this coast. I observed no traces of Glaciation in the vicinity of the Caves, and Mr. Somerville informed me that he had noticed none, although he had examined the rocks here for many years.

The discovery of a small Negroid race here may perhaps be correlated with Sir Harry Johnston's recent researches among the Pygmies and Forest Negroes of Central Africa :—

1. The average height of the Pygmies of the Congo Forest, according to him, is about 4 feet 9 inches for the men, and 4 feet 6 inches for the women. These heights correspond with those of the Negroid skeletons found near Mentone.
2. There is a tradition that a tiny, dark race once inhabited the woods and caverns of Europe, and were known as Gnomes, Fairies, Brownies, or "little people." Can the small Negroid race found near Mentone represent that traditional race ? Sir Harry Johnston remarks that "traits in the character of the Congo Dwarfs of the present day recall irresistibly the tricks of Puck, of Robin Goodfellow, and of the Gnomes and Fairies of German and Celtic tradition."[2]
3. Assuming that the Mentone Negroid type is similar to the Uganda Pygmies, it is interesting to note that Sir Harry Johnston states that scientific Anthropologists, while recognising their coarse features and low development of skull and mind, are of opinion that these Pygmies are not nearer the Ape than is the average Negro.[3]
4. French Anthropologists who have examined the Negroid remains from near Mentone do not consider that they belong to a Simian type.[4] Consequently we may conclude that the Mentone Caves, even in their lowest developed specimens of humanity, have not revealed any Simian racial characteristics in Primitive Man.

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[1] See Dr. Verneau's amplified article on the latest discoveries in *L'Anthropologie* for Sept.-Oct. 1902; also M. Albert Gaudry's article in *La Nature* of 10th May 1902.

[2] *Uganda Protectorate*, vol. ii. p. 514.

[3] *Op. cit.*, vol. ii. p. 512.

[4] *Comptes Rendus*, No 16 *de l'Académie des Sciences de Paris*, 21 Avril 1902.

SECTION OF THE CAVE called "La Grotte des Enfants," near Mentone, explored by the Abbé de Villeneuve for the Prince of Monaco in 1902. (After *La Nature* and *l'Anthropologie*. Paris, 1902.)

DEPTH.		
Yards.	Metres.	
About		*Ashes, pebbles, children's teeth, shells, cave-earth.*
		Burial-place, with numerous *trochus* shells.
$2\frac{1}{8}$	1·90	Strongly-marked hearth.
		Pebbly conglomerate.
$2\frac{1}{3}$	2·50	Another hearth.
$3\frac{1}{2}$	3·20	Thin line of ashes with worked flints.
		Grey cave-earth, almost without pebbles.
$4\frac{2}{3}$	4·20	Another hearth.
		Detritus.
$5\frac{1}{3}$	5·00	Line of ashes.
		Pebbly cave-earth.
$6\frac{2}{3}$	6·10	Strongly-marked hearth.
		Cave-earth.
$7\frac{2}{3}$	7·05	Hearth with burial-place.
		Grey cave-earth, with Nassa shells.
$8\frac{1}{2}$	7·75	Double burial-place on a hearth. (Stones protect the heads.)
		Azoic red clay.
$9\frac{3}{4}$	8·90	Hearth with work of Madeleine age.
		Grey cave-earth.
$10\frac{1}{4}$	9·30	Two lines of ashes converging towards previous hearth.
		Work: Flint, jaspers, worked bone.
$10\frac{3}{4}$	9·80	Wild beasts' tracks, with strongly-marked concretions.
		Wrecked hearth, with implements of sandstone and limestone, rarely of flint.
		Red clay.
		Rock in situ.

UNKNOWN MEXICO.[1]

IN two handsome and beautifully illustrated volumes Mr. Lumholtz describes the results of his residence for the greater part of eight years, between 1890 and 1898, among the aborigines of North-Western Mexico. The tribes which were the objects of his study are the Tarahumares, Tepehuanes, Coras, Huichols, Tepecanos, and Tarascos, and they for the most part inhabit the tracts immediately west of the Sierra Madre del Norte, and the states of Jalisco, Mexico, and Michoacan. These tribes are hemmed in on all sides by Mexicans, and slowly but surely are being absorbed and reduced in numbers, and must ultimately disappear before the forces of civilisation. The students of anthropology and archæology, then, are deeply indebted to Mr. Lumholtz, who has secured for them a

[1] *Unknown Mexico.* By Carl Lumholtz, M.A. Two volumes. London: Macmillan and Co., Limited, 1903. *Price* £2, 10*s.*

vast treasure of information and materials which have hitherto been unavailable to the public. This treasure, it is needless to say, was not secured without much trouble and danger to Mr. Lumholtz and his comrades, but more especially to Mr. Lumholtz, who soon found that he could prosecute his studies and achieve his object with less danger and more success if he worked alone. On this account he broke up the expedition and ventured alone into the country of the aborigines, where by his tact, kindness, and consideration he won their confidence, disarmed the suspicion, and dissipated the fears which are natural to all uncivilised or semi-civilised races: but from the narration it is very clear that this was not accomplished without repeated personal risk of often a very serious nature.

Mr. Lumholtz entered Mexican territory from Bisbee in Arizona, and his first expedition took him to Casas Grandes and to the Mormon settlement, Colonia Juarez, where he had exceptional opportunities of examining cave-dwellings. His excavations of burial caves were rewarded with excellent results in the shape of human remains, shell ornaments, straw anklets and bracelets, cotton cloths and pottery, while from mounds were obtained stone implements, shell beads, jars, bowls, pieces of pyrites and turquoise. After a short return to the United States Mr. Lumholtz proceeded south into the Tarahumare country, and here he came upon caves still in use as dwelling-places. His description of these primitive homes is worth quoting. "In front of the entrance to the cave there is generally a wall of stone, or of stone and mud, raised to the height of a man's chest, as a protection against wind and weather, wild beasts, etc. The cave is fitted up just like the houses, with grinding-stone, earthen jars and bowls, baskets, gourds, etc. The fire is always in the middle, without hearth or chimney, and the jars in which the food is cooked rest on three stones. A portion of the ground is levelled and made smooth for the family to sleep on. As often as not there are skins spread out on the floor. Sometimes the floor space is extended by an artificial terrace in front of the cave. Generally there are one or two storehouses in the caves, and these constitute the chief improvement. . . . The largest inhabited cave I have seen was nearly a hundred feet in width and from twenty to forty feet in depth. If caves are at all deep, the Indians live near the mouth. They never excavate caves, nor do they live in dug-outs. . . . Inhabited caves are never found in inaccessible places, as is the case with cliff-dwellings in the south-western part of the United States. Where caves are difficult of access, the Indians may place a wooden ladder, or rather a notched tree trunk, which is the national style of staircase. . . . The Tarahumares are not the only tribe still clinging to caves. As we have seen, the Pimas, too, are to a limited extent cave-dwellers, and the same is the case with the northern Tepehuanes, as well as with the allied Huarogios in their small area."

The reader cannot fail to observe, that although backward for even an uncivilised race, the Tarahumares earned the esteem and even the admiration of Mr. Lumholtz. He describes them as strictly honest, very intelligent, hard working, and possessed of considerable ingenuity, hospitable, simple, and law-abiding. Indeed, his description of a criminal

trial at which he was present is too good to be omitted. "Presently the two culprits, a man and a woman, came forward with never a suggestion in their placid faces that they were the chief actors in the drama about to be enacted. They seated themselves in front of the judges, while the witnesses took their places behind them. The mother of the woman sat close by her guilty daughter, but there was no other exhibition of sentiment. The judges did most of the talking, addressing questions to the defendants, who made a few short answers; the rest of the assemblage observed a decorous silence. There were neither clerks nor lawyers. I was, of course, not able to follow the testimony, but it was very short, and it was explained to me that the woman had run away with a married man. They had provided themselves with plenty corn from the man's former home, and furthermore had stolen some beans, and lived very happy in a cave for a year. The man could not be captured, even though on several occasions he visited his family. But they frequently made native beer, and got drunk, and while in this condition they were caught and brought before this tribunal.

"While the trial was going on, one of the 'soldiers' got up and went some twenty yards off, dug a hole in the ground and planted a thick pole or post in it. No sooner had he completed his task than the accused man rose with a queer smile on his face, half chagrined, half sarcastic. Dropping his blanket, he walked deliberately up to the pole, flanked by two soldiers, each of whom took hold of his hands, and by putting them crosswise on the further side of the pole, made the culprit hug the pole very tightly. Now another man, wrapped closely in his blanket, stepped briskly up, drew as quick as a flash a leather whip from under his garment, and dealt four lashes over the shoulders of the prisoner, who was then released, and stolidly walked back to his seat as if nothing had happened.

"Now came the woman's turn to be punished for her part in the thefts. They took off her blanket, but left on a little white undergarment. She was marched to the pole and held in the same manner as the man; but another man acted as executioner. She too received four lashes, and wept a little when they struck her, but neither she nor her fellow-sufferer made any attempt at, or sign of, revolt against the sentence of the court. While the chastising went on, the audience rose and stood reverently. After returning to her seat the woman knelt down, and both delinquents shook hands with the chief judge.

"There still remained the second part of the accusation to be dealt with, the one relating to the marital complications. The man asked permission to leave his first wife, as he wanted to marry the woman with whom he ran away. But no divorce was granted to him. He was ordered to return to his legitimate spouse, who was present at the proceedings with her child in her arms. Evidently disappointed, he slowly stepped over to where she was standing and greeting him with a happy smile.

"But the woman with whom he had been living had now to be provided with another husband. Who would take her? The judge addressed the question to a young man, a mere boy, standing near by.

and he replied that he would marry her, if she were willing. She said Yes, so he sat down beside her. Their hands were placed together, the gobernador said a few admonishing words to them, and they rose man and wife duly married. How was this for rapid transit to matrimonial bliss?"

It goes without saying that so simple a people are much in the hands of their *shamans* or medicine men, and are extremely superstitious. Mr. Lumholtz has succeeded in ascertaining and recording many of their beliefs and folklore, in which are found many traces of Christian truths and legends which have come down to the Tarahumares from Spanish missionaries. As a race they are fond of exercise and sport, especially dancing and running races; in reference to the latter form of exercise, Mr. Lumholtz says: "The Tarahumares are the greatest runners in the world, not in regard to speed, but endurance. A Tarahumare will easily run 170 miles without stopping. When an Indian is sent out as a messenger, he goes along at a slow trot, running steadily and constantly. A man has been known to carry a letter in five days from Guazapares to Chihuahua and back, a distance nearly 600 miles by road.'

Probably the most remarkable peculiarity of the Tarahumares, and, we may add, of the Huichols, who inhabit a tract some hundreds of miles further south, is the cult of the hikuli, or cactus, more especially the variety known to botanists as *Lophophora Williamsii var Lewinii*. To get this plant the Tarahumares have to go to the Sierra del Almoloy and to the Sierra del Margoso, and the Huichols have to undertake a forty-three days' journey to Real Catorze in the State of San Luis Potosi. But as the firm belief of the aborigines is that the health of the community, the prosperity of the state, the success or failure of the crops, in fact, their general and individual welfare, depend on getting an abundance of hikuli and on propitiating hikuli as a potent deity, no pains are spared, and no private interests are allowed to interfere with the procuring of hikuli from wherever it can be found. The estimation in which it is held may be gathered from the following remarks of Mr. Lumholtz. "Hikuli is a powerful protector of its people under all circumstances, and it gives luck. If a man carries some hikuli in his belt, the bear cannot bite him and the deer cannot run away, but become quite tame and can easily be killed. Should he meet Apachis, hikuli would prevent them from firing off their guns at him. It gives luck in foot-races and all kinds of games, in climbing trees, etc. Hikuli is the great safeguard against witchcraft. It sees even better than the *shamans*, and it watches that nothing bad is put into the food. . . . The Christian Tarahumares make the sign of the cross when coming into the presence of the plant, and I was told to lift my hat to it. It is always saluted in the same way as a man, and is supposed to make the customary responses to salutations. Hikuli is not as great as Father Sun, but sits next to him. It is the brother of Tata Dios, and the greatest hikuli is his twin brother, and is therefore called uncle." The plant is well known in the United States as "mescal buttons," and "when taken, exhilarates the human system and allays all feeling of hunger or thirst. It also produces colour-visions. When fresh, it has a nauseating,

slightly sour taste, but it is wonderfully refreshing when one has been exposed to great fatigue. Not only does it do away with all exhaustion, but one actually feels pushed on, as I can testify from personal experience. In this respect it resembles the Peruvian coca, but, unlike the latter, it leaves a certain depression as well as a headache." The cult of the hikuli is unquestionably the most remarkable feature of the religion and daily life of these two tribes, and Mr. Lumholtz has very justly assigned to it an important place in his work, and shows good reason for suggesting that it is of great antiquity.

The Tepehuanes, a tribe numbering about 4000, inhabit a territory along the Sierra due south of the tract inhabited by the Tarahumares, and are more active, proud, and independent than the latter. They are rapidly losing their lands to the Mexicans, who take advantage of their love of "mescal," and cheat them in wholesale fashion. Mr. Lumholtz lived some months with them, and has recorded many of their beliefs and customs and habits. Among the Christian Tepehuanes the code of punishment for offences between the sexes is ludicrously and almost incredibly severe. "Sometimes punishment is dealt out to young people for being found talking together. Outside of her home a woman is absolutely forbidden to speak to any man who does not belong to her own immediate family. When fetching water, or out on any other errand, she must under no circumstances dally for a chat with a 'gentleman friend.' Even at the dancing-place it is against the law for her to exchange a few words with any young man. If discovered in such a compromising position, both offenders are immediately arrested, and their least punishment is two days' imprisonment. If their examination by the judges proves that their conversation was on the forbidden topic of love, they get a whipping and may be compelled to marry."

When at Morelos Mr. Lumholtz had the good fortune to be able to measure and photograph some specimens of Tubar Indians, a tribe resembling in many ways the Tarahumares, but so near extinction, that he was informed there are now not more than a couple of dozen pure-bred Tubars left, and only five or six of them know their own language. Holding still south, he entered the regions of the Coras, a tribe which now number only some 2500, and staying some time with them he succeeded in inducing many of them to be photographed and measured. In a tract due west from the Coras live the Huichols, an interesting race, numbering about 4000, an account of whom occupies the greater part of Mr. Lumholtz's second volume. "The Huichols (pronounced Veetchol) although related to the Aztecs, belong to the tribes which remained in barbarism while the main stock of the family developed and reached a state of culture culminating in the establishment of the Aztec empire. Montezuma's reign came to a tragic end nearly four hundred years ago, while the humble Huichols have maintained themselves to the present day in their almost inaccessible mountain fastnesses. True, they too were conquered by the Spaniards in 1722, and Franciscan missionaries followed the victorious soldiers and built five churches. Nominally the tribe then became converted to Christianity, and the introduction of cattle, sheep, mules, and certain iron implements, modified to some extent

their mode of living, though not as much as one would expect. To-day, however, the churches are in ruins, and there is no priest living among the Huichols. The most civilised of them know how to make the sign of the cross, and are familiar with the names of Maria Santissima, Dios, and Diabolo. Many are clever enough to put on an external show of Christianity towards people from whom they expect some favour. All of them observe the leading Christian feasts, which offer occasions for prolonged enjoyment of eating and drinking, and they worship the saints as so many gods. The ancient beliefs, customs, and ceremonies still have a firm hold on the minds of the people, and the Huichols jealously guard their country against the encroachments of the whites. The impress the victors made was superficial, and to-day the natives are practically in the same state of barbarism as that which they enjoyed the day when Cortes first set foot on American soil." Mr. Lumholtz made a special study of the Huichols and lived among them for many months, and having won their confidence and regard, he was permitted, and even welcomed, as a guest at their many feasts and religious ceremonies, for a detailed description of which we must refer our readers to his book. Religion he shows to be an integral and absorbing factor in the Huichol's life and art. "Religious feeling pervades the thoughts of the Huichols so completely, that every bit of decoration he puts on the most trivial of his everyday garments or utensils is a request for some benefit, a prayer for protection against evil, or an expression of adoration of some deity. In other words, the people always carry their prayers and devotional sentiments with them in visible form."

Leaving the Huichols Mr. Lumholtz passed south through a tract in which he gathered much information regarding the present Aztecs, and thence he passed into the regions inhabited by the Tarascos, where for once his usual tact and skill in dealing with Indians failed him. An Indian died while he was there, and he endeavoured in the cause of science to get possession of the body, and thereby incurred the ineradicable suspicion and dislike of the Tarascos, which resulted in vehement opposition and threats of personal violence. If, however, he was unsuccessful in getting the body of a Tarasco newly dead, he succeeded in getting over a hundred skulls of Indians out of a burial-place in the vicinity. It is not astonishing that in an ignorant and superstitious race his proceedings excited fear and anger. His general opinion of the Tarascos is, that they are intelligent and industrious, skilful as artisans and musicians, upright and brave, healthy, but dirty in their persons, irritable, very superstitious, and having a profound dislike of foreigners. *Apropos* of music, he tells us in his preface that he succeeded in recording sixty Indian melodies on the graphophone, and some melodies with the accompanying words are transcribed into his work. We have left ourselves no space in which to refer to his very interesting remarks upon, and estimate of, the skill and taste displayed by the various tribes in their arts and manufactures, *e.g.* weaving, pottery, lacquer-work, ornaments, etc., and it is best for the reader to read them for himself with the help of the numerous excellent illustrations, several of them coloured, which are a distinctive feature of this book. In conclusion we

can only repeat that Mr. Lumholtz has made a brilliant contribution to our knowledge of the aboriginal tribes of Mexico, for which anthropologists and archæologists cannot fail to be very grateful.

THE ISLANDS OF ST. PIERRE AND MIQUELON.

M. Le Breton gives[1] an interesting account of these tiny islands, the last which remain of the French colonies in North America. Lying close to the south coast of Newfoundland, they are separated from each other by a channel 5 or 6 kilometres wide. Miquelon itself is composed of two islands, the northern, or Grande Miquelon, having an area of a little over 11,400 hectares, while the southern, or Petite Miquelon, has an area of over 9000 hectares. The two islands are united by a belt of sand 10 kilometres long and from 400 to 500 metres wide. At the end of the eighteenth century this isthmus was pierced by a channel accessible to small boats, but this no longer exists, and one can go dry-shod from one island to the other. At its northern end, at its point of junction with Grande Miquelon, the isthmus widens so as to shelter behind its dunes a large basin called the "Barrachois of Miquelon" which, on its eastward side, is in constant communication with the sea by a very short channel which, in certain states of the tide, can afford a passage to vessels drawing very little water. This basin consists of a sheet of water 3 kilometres long and 2 wide, with a depth of from 3 to 5 metres. Should need arise, this lake could, by the deepening of the channel leading to it, be transformed into a very convenient harbour.

The coast of the island is formed of cliffs rising steeply out of the sea, and not only affording no hope of shelter, but rendered more dangerous by reason of the frequent squalls. This fact, and the presence of the isthmus of sand mentioned above, have been the cause of numerous shipwrecks, two hundred and two vessels having perished there between 1816 and 1901. Now two large lighthouses, one on each of the Miquelon islands, warn the navigator of the proximity of land. This inhospitable and forbidding character is the true cause of the destitute condition of Miquelon, which even to-day only contains half a thousand inhabitants, but there seems reason to believe that a new era of prosperity is about to open for this little corner of French territory.

The island of St. Pierre is much the smaller of the two islands, covering only 2600 hectares. Although the nature of its soil and of its subsoil are identical with those of Miquelon, the geological formation of the two islands appears to be different. Miquelon seems to have been upheaved from the waves by a single convulsion, after which calm has reigned. St. Pierre, on the other hand, appears to have been formed by a series of minor seismic disturbances, raising a cape here, carving out a bay here, thrusting up an isolated rock far out at sea, or an islet nearer

[1] In *Questions Diplomatiques et Coloniales*, No. 147, pp. 411-28. For the loan of the map illustrating this article we are indebted to the courtesy of the editor of *Questions Diplomatiques et Coloniales*.

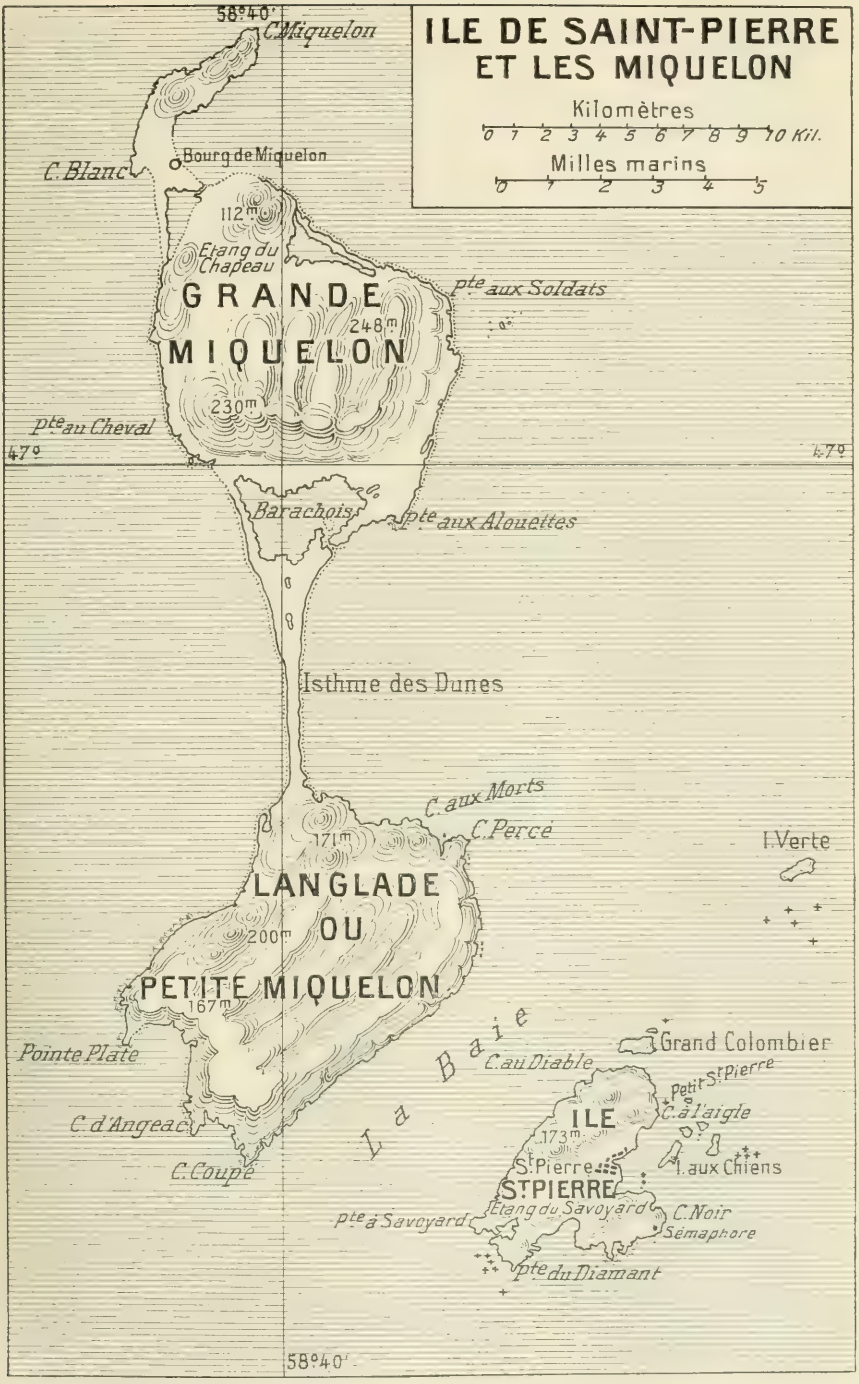
at hand to close in the roadstead. Except in the north-west, opposite Miquelon, the coasts are less abrupt. Small coves offer during the summer shelter to the numerous fishing-boats, and the squalls are less severe. To the east of the island is a bay which serves as a roadstead; it is sheltered by the Île aux Chiens, a long and rocky islet inhabited by 650 people. The entrance to the bay is to the south-east, and has been protected against heavy seas by a stone breakwater. Thus a harbour, lacking at Miquelon, exists on this island, and this explains the presence of the town of St. Pierre, on a rock smaller than the Paris of the left bank. In short, the mariner, after his long voyage across the Atlantic, found here a port to rest in, and hence this island has been selected as a fishing-centre by the Basque, Norman, and Breton vessels which have frequented these latitudes since before the days of Christopher Columbus.

The islands of St. Pierre and Miquelon, though situated on the latitude of the valley of the Loire (lat. 47°), have a cold climate. The isothermal line which traverses them passes near the Faroe Islands, lat. 62°, this lowness of temperature being due to the absence of the influence of the Gulf Stream.

The summer is never hot, the heat of the sun being tempered by frequent fogs. The winter is long and cold, the thermometer falling sometimes to −18°, and every winter being frequently at −10° and −12°. The natives say, however, that for some years back the climate has been growing milder; for proof of this they point to the fact that formerly the roadstead was often frozen so hard that sledges drawn by horses could pass freely between St. Pierre and the Île aux Chiens. It is long, however, since this happened.

From the end of November to the end of March snow covers all the ground, and here as elsewhere serves as a kindly protection against the severe cold. In the depth of winter, when the north-west wind blows, the snow rises in whirlwinds of fine powder and penetrates through the most tightly closed doors and windows. These rare storms are always followed by dry, calm weather, which allows the inhabitants to indulge in the pleasures of skating and of duck-shooting. The south-east winds bring about a rise of temperature, but also rain and fog. Fogs are most frequent in June and July, to the great detriment of the fishermen. On the whole, then, the climate is cold, but perfectly healthy. As to the produce of the soil, the rocky surface of St. Pierre is covered by a layer of peat, which retains the rain water and so causes numerous ponds. On this peat grow a very thick moss, lichens, and a little grass, which affords pasture to a few grazing animals, milch cows, sheep, and oxen, destined for slaughter. Then on the hills, between the rocks, grows a low, stunted shrub, with twisted branches, of the pine family. Sometimes, in sheltered spots, this shrub attains a height of 1 metre, or 1·50 metres. Such is the whole flora of St. Pierre.

Miquelon has sufficient soil to permit of the establishment of farms devoted to the rearing of cattle, the keeping of poultry, and the growing of certain vegetables, but as yet nothing much has been done in this direction. Hundreds of acres, left in a state of nature, form a splendid


ILE DE SAINT-PIERRE
ET LES MIQUELON
Kilomètres
0 1 2 3 4 5 6 7 8 9 10 Kil.
Milles marins
0 1 2 3 4 5
58°40'
C. Miquelon
C. Blanc
Bourg de Miquelon
112m
Etang du Chapeau
GRANDE
MIQUELON
248m
230m
pte aux Soldats
pte au Cheval
47°
Barachois
pte aux Alouettes
Isthme des Dunes
C. aux Morts
C. Percé
171m
LANGLADE
OU
PETITE MIQUELON
200m
167m
Pointe Plate
C. d'Angeac
C. Coupé
La Baie
I. Verte
Grand Colombier
C. au Diable
Petit St Pierre
C. à l'aigle
ILE
173m
St Pierre
ST PIERRE
I. aux Chiens
Etang du Savoyard
C. Noir
Sémaphore
pte à Savoyard
pte du Diamant
58°40'

habitat for the white partridges and the rabbits which are almost the only inhabitants of this region. The people of St. Pierre now wage a deadly warfare against them, and in spite of official restrictions the game is fast being destroyed, not only by sportsmen, but still more by the inevitable poacher.

Numerous streams, filled with trout, traverse the island, and would facilitate the irrigation of vast meadows. Extensive woods furnish an economical supply of fuel and the material necessary for the construction of houses and sheds.

The whole soil is covered with a crowded vegetation. Mosses, lichens, small plants with coriaceous leaves, and grass form a thick and soft carpet into which the foot sinks. The summit of the hills is bare, and here and there the rock appears, removing all hope of ploughing. A few scattered cattle, however, find pasture there, and, with the expenditure of a little trouble, the soil could, without a doubt, be made to produce potatoes, cabbages, and meadowland. In fact, vegetation develops so rapidly that several harvests of fodder are possible in spite of the short duration of the fine weather. At present, fruit, vegetables, bread, meat, all come from Sydney (Cape Breton), Halifax, or Boston, and St. Pierre has not in itself a week's food-supply. It is hoped, however, that this state of things is about to be changed, and that from 1904 onwards the kitchen-gardens and the flocks on Miquelon will be sufficient to supply the people of St. Pierre with at least meat and the larger kinds of vegetables. As for corn, that of America is too cheap and too near at hand to challenge competition.

With regard to mineral wealth, it has been found that no hopes can be entertained. But if the land is thus poor, the sea contains a source of wealth which for two hundred years has nourished thousands of men. This is the cod, the capture, preparation, and transport of which insure in France alone the labour of fifteen thousand men, and the existence of perhaps forty thousand persons. The sea is a mine which can be made inexhaustible, if proper measures are taken. Already the cod is becoming somewhat scarce round about Newfoundland, and to prevent this state of things from becoming worse something will soon have to be done.

The commercial centre of the fishing industry is the town of St. Pierre. Its stationary population is more than 5000, of whom 900 are English, but in summer this is increased by a thousand, while several thousand others, living on the open sea, depend upon it. The houses, all built of Canadian wood, are protected against the cold by their system of construction, and most of them are also heated by steam on the American plan. The town is lighted by electricity, and all the chief commercial houses are connected by telephone. It is kept in communication with Brest by two cables, one belonging to an English and the other to a French company. By the latter news comes from France every day. St. Pierre also communicates twice a week with Sydney (Cape Breton) by means of a French steamer. It is much to be wished that there were a regular postal service to bring every week, at least for six or eight months of the year, the mails left at New York by

the Havre mailboat. There might also be a coasting service between the colony and Placentia, on the south coast of Newfoundland, in order to take advantage, thanks to the railway which connects the south coast with the capital, of the steamers which frequently call at St. John's.

The chief manufactures are — that of ship biscuits, made from American flour, that of fishermen's clothing, and that of paint for the keels of ships. There are also a few minor industries. For want of wood, the shipowners buy their schooners in America, where they are very well made and very cheap.

The town is very well supplied with water, brought from the numerous ponds. What perhaps strikes a new-comer most is the total absence of trees. One views as a curiosity the garden of a big shipowner, who, in a twenty-five years' stay, has succeeded in rearing around his house half a dozen trees, which have now a height of 6 or 7 metres. Here and there too is to be found a little garden a few metres in extent producing vegetables, the cultivation of which serves as a distraction to the shipowner or fisherman.

Several carriage roads lead out of the town for a little way. Beyond these there are only to be found stony paths, used only by the cattle, or by the ox-wagons which bring into the town faggots or stones. At the end of each of the roads of the islands is to be found a group of huts inhabited in the summer by the fishermen of the Île aux Chiens, who come there to be near their fishing-ground. In winter these huts are almost all deserted.

The administration of the colony is very simple. At the head is a governor, a political personage who is changed pretty often and who lives very little among those he governs. He is assisted by a privy council of three members, which is at the same time a council of administration. Side by side with the governor are the service of the interior, concerned with general questions of police and with finance, and the various tribunals of justice.

The cod are chiefly captured on the Newfoundland Banks, so called because they lie near that island. These banks are vast submarine plateaus giving soundings of less than 100 metres, while all around them the depth is about 500 metres. In long. 47° and lat. 47° is a small bank called the "Bonnet flamand," famous for the size of the cod captured there, but the distance from St. Pierre and the great depth of the water make it possible only for large ships to engage in fishing operations there. Further west is the Great Bank, extending between long. 51° and long. 57°, and lat. 44° and lat. 47°. Triangular in form, it covers about 115,000 square kilometres, and has a depth varying between 50 and 100 metres. It is the most frequented fishing-ground. Further west still are some banks of small extent, namely, the Green Bank, the St. Pierre Bank, the Misaine Bank, the Banquereau, and the Bank of Sable Island. In all these there is complete absence of restriction, and English, French, and Americans meet freely—"first come, first served."

As a fishing-ground on the open sea, one ought to mention the Gulf of St. Lawrence, often frequented by the St. Pierre schooners at the

beginning of the season, when bad weather is still to be dreaded on the banks. These schooners follow the fish in their movements as far as to the French Shore.

Next come the territorial waters; first, the band of three miles of sea surrounding St. Pierre and Miquelon, in which all fishing rights are strictly reserved to those of the French nation; and second, the French Shore, a strip of about 1000 kilometres along the west coast of Newfoundland and the east coast of the large northern peninsula. Here too the right of fishing is reserved exclusively to the French, who are also allowed, in accordance with the terms of the treaties, to establish on land dwelling-houses, drying-grounds, and so forth.

The cod is not only a highly nutritive fish, and one very easily preserved, but hardly any part of it need be wasted. The head, and that part of the backbone which is removed, may be used for making soup, while the tongue is regarded by fishermen as a delicacy. The roe is sought after for use in the sardine fishery, and the liver, stored in barrels, yields by its decomposition the famous cod liver oil, the oil of the second quality being used in tan-yards.

The cod having been caught, the sailors set to work to cut it up. The operation takes place on a table, and requires two men and a boy. When cleaned, the cod is passed on to another person, who salts it. It may remain in salt for several months without being in the least spoilt. When the boat has arrived at St. Pierre or in France, the cod is unshipped, washed in sea-water, and finally put to dry, either in the sun on the beaches of the French Shore or of St. Pierre, or in steam drying-houses as at Bordeaux. The test of its being ready for use is that it should remain quite stiff when held up by the tail. It is then sorted according to size, and placed in warehouses till it can be sent to market. All the work involved in its preparation demands great skill and care, as the least fault will suffice to bring about a lowering of price.

PLANT-DISTRIBUTION IN EUROPE IN ITS RELATION TO THE GLACIAL PERIOD.

It is a geographical commonplace that the present distribution of plants throughout most of Europe must have originated subsequent to the glacial period, when the old flora must have been wiped out over large areas, but to trace in detail the connection between the existing distribution and the climatic variations roughly summed up in the term Glacial Period is a matter of much difficulty. As a rule, the botanists have been more occupied with the cataloguing of the anomalies of distribution than with the very difficult task of explaining them. But among those who have attempted this difficult problem is Dr. August Schulz, who has written a number of papers on various aspects of plant-distribution. Some of these are of great interest, and it is proposed here to give a summary of one of them, which deals only with a minor problem—the

distribution of halophytes, or salt-loving plants, in Central Europe.[1] Both the terms used in this title require definition. Halophytes are plants which by reason of their fleshy leaves, or other peculiarities, are able to tolerate the presence of a certain amount of common salt in the soil, usually a proportion which would be fatal to plants not possessing the halophytic modifications. Again, Central Europe in Dr. Schulz's terminology means the area included between the northern border of the Alps and the Carpathians on the south, South Sweden on the north, the Maas and Doubs on the west, and the Vistula and March on the east. It thus excludes the whole of the British area. Within the area so defined, halophytes occur in two sets of regions. First, along the margin of the ocean, where the soil is impregnated with salt from the sea, and, second, in certain inland regions, where, owing to the occurrence of rock-salt in certain geological formations, the soil is impregnated with salt, and salt springs, lakes, and pans occur. The special point of interest as regards these last-named areas is that they are obviously isolated, and not continuous, so that their flora must have reached them across non-salt-bearing regions.

It is not necessary to give here a list of the halophytes which occur within the Central European area, it may be sufficient to notice the different groups into which they fall. Certain of them, such as the species of *Zostera* or grass-wrack, *Cakile maritima* or sea-rocket, *Crambe maritima* or sea-kale, *Armeria maritima* or sea-thrift, and many others, are in the area named peculiar to the sea-margin, and do not occur inland. On the other hand, there are a few forms, such as *Capsella procumbens*, *Achillea asplenifolia*, and some others, which are confined to inland salt-bearing regions, and do not occur on the seashore at all. A third group, including sea-milkwort (*Glaux maritima*), several species of wormwood (*Artemisia*), the sea-plantain (*Plantago maritima*), sea-aster (*Aster tripolium*), and so on, are to be found both on the seashore and in inland salt marshes, etc. Again, some of the halophytes, such as the species of *Zostera*, sea-holly (*Eryngium maritimum*), and others, are so thoroughly adapted to their specific habitat that they are unable to hold their own, in the general case, where the soil is not strongly impregnated with salt. Others again, such as the horned pondweeds, *Zannichellia pedicellata*, and *Z. polycarpa*, and sea arrow grass (*Triglochin maritima*), are capable alike of living upon ground rich in salt and on that poor or almost devoid of it. A third group, represented, *inter alia*, by scurvy-grass (*Cochlearia officinale*), includes plants which occur in two varieties, one halophytic and one normal, each with its specific habitat.

Distribution of Maritime Halophytes.—In studying the distribution of the halophytes of Central Europe, we may begin with the maritime forms. In the western part of the maritime region, that is in the part between Skagen and the mouth of the Schelde, there occur in all some eighty-one species and many maritime varieties. This western region may be

[1] "Die Verbreitung der Halophilen Phanerogamen in Mitteleuropa nordlich der Alpen." Von Dr. August Schulz. *Forschungen zur deutschen Landes u. Volkskunde*, xiii. 1901.

divided into three parts: (1) the region from Skagen to the mouth of the Elbe; (2) the region between the mouths of the Elbe and the Ems; and (3) the region from the mouth of the Ems to the mouth of the Schelde. Of these three, the middle region (2) is much the poorest in species. The most southerly region (3) has in all sixty-seven species and many varieties. Of the total species, eight do not occur in the other two regions, and seven of these do not occur in the Central European area (as defined above) except in this one district. The remaining species is also found in the region east of Skagen. Five of the species found in the region under consideration do not occur between the mouths of the Ems and Elbe (region 2), but reappear to the north of the Elbe, between its mouth and Skagen (region 1). Some three species found in this region also occur in the mid-region (2), but are absent from the northern (1), so that the affinities of (1) and (3) seem greater than those of (2) and (3). Region 2 has in all only fifty-five species out of the eighty-one found in the entire district, and of the fifty-five only one seems peculiar, *i.e.* absent from (1) and (3). Region 1 has a total of sixty-eight species, of which ten do not occur in (2) and (3).

As regards the eastern portion of the maritime region of Central Europe, that is the region from Skagen eastward to the eastward limit of the region, it is found that here many of the western species are absent, though on the other hand there are a few peculiar species. Between Skagen and the line drawn through Bornholm, Rügen, and Wollin the character of the flora alters but little, but from this line eastward to the limit of the Central European region the littoral halophytic flora becomes increasingly poor. Between Skagen and the line drawn as indicated above, there are some sixty-eight species, of which twenty-six do not appear to cross the line, and are therefore absent from the extreme eastern region. As regards the part of the Baltic coast of Sweden which falls into the Central European area, some ten species which are present on the coast of Denmark and Germany are here absent, while there are about seven species which do not occur there, giving a total of sixty-five. The part of the Swedish coast which faces the Skager Rack and Cattegat contains eleven species absent on the Baltic coast, but is without ten of the species which occur there, so that its total number of species is sixty-six.

Distribution of Inland Halophytes.—In studying the distribution of the inland halophytic flora of Central Europe, it is convenient to begin with the salt-bearing region of the Saale district, a district which constitutes a singularly well-defined floral region. The salt-bearing part of the district is extensive, and is bounded by a line which passes through the vicinity of Magdeburg, Schönebeck, Zerbst, Köthen, Zörbig, Landsberg, Schkeuditz, Markranstädt, Hohenmölsen, Kösen, Sulza, Weimar, Erfurt, Arnstadt, Gotha, Tennstedt, Greussen, Sondershausen, Heringen, Kelbra, Sangerhausen, Eisleben, Gerbstedt, Aschersleben, Quedlinburg, Halberstadt, Dardesheim, Hornburg, Wolfenbüttel, Braunschweig, Königslutter, Helmstedt, Calvörde and Wolmirstadt, thence back to Magdeburg. Throughout the greater part of this area there occur considerable extents of surface rich in salt, which is only absent in a few localities, especially

where the soil and the original flora have been alike modified by man. With these exceptions the region for an inland district is singularly rich in halophytes, for it possesses twenty-nine species. Of these one (*Capsella procumbens*) is distributed throughout Central Europe, four others are common inland plants in Central Europe, while other two (*Artemisia laciniata* and *A. maritima*) occur, the one only in this region throughout Germany, and the other only here in the inland parts of Germany. Of the total species only ten are uniformly distributed through the area, all the others are local in their distribution in the region, while three species (*Limnochloe parvula*, *Sagina maritima*, and *Batrachium baudotii*) are each found only in one place. On account of this want of uniformity of distribution, it is possible to divide the Saale area into sub-regions, characterised by positive characters, such as the presence of particular plants, or negatively by the absence of certain species. Of these sub-regions that poorest in halophytes is, as is to be expected, that which is poorest in salt.

The next salt-bearing region to be considered is of smaller size, and is less rich in species. This is the district bounded by a line drawn through the following localities:—Hannover, Lehrte, Sehnde, Hildesheim, Salxdettfurth, Salzgitter, Liebenburg, Langelsheim, Osterode, Seeburg, Allendorf, Kreuzburg, Gerstungen, Salzungen, Fritzlar, Kassel, Trendelburg, Karlshafen, Moringen, Salxderhelden, Eschershausen, Münder, Rodenburg, Gehrden, and Linden, and back to Hannover. Within this area are many places in which halophytes have never been known to occur, while in others they have disappeared recently. The total halophytic flora includes only about fourteen species, which are not uniformly distributed, some species being absent in parts of the region, and some being very rare, known to occur in few places only. This region may be called the Eastern Ober-Weser-Ems region, and is to be distinguished from the Western Ober-Weser-Ems region, which is included in a line drawn through Salzbergen, Rheine, Bevergern, Gravenhorst, Osnabrück, Osterkappeln, Melle, Oeynhausen-Rehme, Salxuflen, Pyrmont, Schieder, Salzkotten, Westernkotten, Soest, Werl, Unna, Kamen, Kurl, Wanne, and back to Salzbergen. In this region five of the halophytes of the Eastern district are absent, but two species not represented there occur here, giving a total of eleven species.

Somewhat richer in species than this region is the Jeetze salt-bearing district, which is divided into two strips, the one extending from Alten-Salzwedel by Salzwedel, Blüthlingen and Wustrow to Reetze on the left bank of the Jeetze, and the other stretching along the right bank through the Luciewald by Gross-Heide, Nebenstedt and Klein-Gussborn to the vicinity of Dannenberg. This region has numerous strongly saline localities, and has a fairly rich halophytic flora. It does not possess *Ruppia rostellata*, present in the Eastern Ober-Weser-Ems region, but it has four species absent in that region, giving a total of seventeen species. Between this salt-bearing region and the Saale district there are some saline patches, at which occur in all some five species of halophytes. Between the four salt-bearing regions just discussed and the sea-coast between the Elbe and the Ems, there

are but few salt-bearing regions, and those present are poor in salt and distant from one another. In all this stretch of country contains some eleven halophytes, mostly restricted to the vicinity of Celle and Luneburg. Throughout this region the halophytes seem in process of extermination by cultivation.

To the south of the two regions of the Ober-Weser-Ems district, halophytes first appear in any considerable numbers in the Wetterau salt-bearing region, which is bounded by a line passing through the vicinity of Grüningen, Hungen, Nidda, Ortenberg, Selters, Büdingen, Vilbel, Rödelheim, Soden, Kronberg, Nauheim, Butzbach, and back to Grüningen. In this region the salt-pans are numerous, and the amount of salt considerable. The halophytic flora of this region contains seventeen species, being one more than that of the two Ober-Weser-Ems regions put together.

To the south and south-east of this region, salt-pans are few and scattered, and in the whole region included between the Rhine, the northern border of the Alps, the Bavarian Forest, the Oberpfalzer Forest, the Fichtelgebirge, and the Frankenwalde there only occur some fourteen halophytes, mostly very locally distributed. More important is the halophytic flora of the vicinity of the Upper Rhine, which constitutes a region which may be called the Rhine-Nahe salt-bearing region, and contains fourteen species. The salt-pans of the Lorraine region are more numerous than those of the preceding, and yet its halophytic flora contains only thirteen species. Among these the most interesting form is *Odontites litoralis*, which has only been found in this region in the inland parts of the Central European region.

To the east of the eastern border of the Saale region and the Elbe stretches a part of Germany, bounded on its eastern side by the eastern border of the Central European region, which is poor in salt-pans. This region contains in scattered localities about twenty-three species, while the region which lies between the eastern border of Germany and the eastern border of Central Europe contains about seventeen species, chiefly in the vicinity of Strelno and Inowrazlow. To the south of Eastern Germany there are districts of Central Europe with considerable halophytic floras. In Bohemia occur some fourteen species, in Moravia and parts of Austria thirty species.

Cause of the Peculiarities of Distribution of Halophytes through Europe.—In approaching the problem of the reason for the peculiarities of distribution of the halophytes of Europe, it is necessary to consider first the general question of the development of the existing flora of Central Europe. During the Glacial Period proper, it is possible to distinguish five epochs of cold. At the beginning of the last of these there were in Central Europe comparatively few plants adapted for life under cold conditions, and those which existed had but a limited distribution. Most of the plants of this type which entered the area during the fourth period became extinct in the period of highly continental climate which followed the fourth period, and their place was taken by a series of plants adapted to a continental climate which entered the area at this time. These plants in their turn were eliminated by the increasing

cold which ushered in the last glacial epoch. Europe was then occupied by plants adapted to a climate in which the summer was cold, some of whom had perhaps managed to survive, in mountain regions, the previous continental period.

When the ice of the last epoch began to melt, the present Baltic Sea, owing to the depression of its shores, was much larger than it now is, and communicated by a broad arm through the region of Lakes Mälar, Wener, and Wetter with the North Sea, as well as in all probability with the White Sea. Later in the period a process of gradual elevation made the first communication narrower and narrower, until finally, before the close of the period, the Baltic became shut off from the North Sea, and constituted a closed sea, probably almost fresh, the Ancylus Lake of the Scandinavian geologists. Originally much larger than the present Baltic, the lake probably first grew smaller, but before the ice of the north diminished to its present proportions the lake once more increased, and perhaps again for a time communicated with the North Sea. At the time when the lake reached its maximum size, the climate of Central Europe was probably colder and damper in summer and milder in winter than at present, but it gradually underwent a change. It became increasingly continental in character, that is, the summers became hotter and the winters colder, until in Central Europe generally the climate ultimately acquired the extreme character now seen in South-east Russia. These changes produced a marked effect on the flora. The forms which had become adapted to the extreme cold of the height of the period were killed off by the wet summers and mild winters of the cold period, while the forms adapted to this climate similarly were unfitted for the extreme continental form which appeared later. During this time much of Europe acquired a vegetation of a steppe-like character. At this period the Ancylus Lake had greatly shrunk, and was represented by a number of inland lakes, some of which had effluents and were fresh, while others had no outlet and would be salt. At a later period the climate again lost its extreme character, and became more like that of Central Ireland at the present time. Corresponding changes in the flora followed, one change being the gradual spread of forest over the Central European area. With the increase in the precipitations during this period, the lakes which occupied the Baltic area increased in size, a process assisted by the depression of the region, and became united with one another and with the North Sea. Through the last opening a large body of warm salt water entered the Baltic, which then had a much higher percentage of salt than at present, as well as a much greater area. To this sea the Scandinavian geologists give the name of the Litorina sea. These two periods may be described respectively as the first hot and the first cool period. The first cool period was of limited duration, and was succeeded by a second hot period, during which the Baltic lost its communication with the North Sea, became very much fresher, while at the same time the forests of Central Europe diminished greatly in extent. This period was followed by a second cool period, during which the forests of Central Europe once more became extensive, while once more the Baltic area sank. No

marked oscillation of climatic conditions again took place, but the climate of the second cool period gradually lost its insular character in Central Europe, and by an increase in the heat of summer and the cold of winter, and a diminution in the amount of rainfall, became more continental in type, the condition in which it has subsequently remained. Six periods may thus be distinguished since the last glacial epoch: (1) the initial cold period; (2) the first hot period; (3) the first cool period; (4) the second hot period; (5) the second cool period; and finally (6) the existing period. It is within these six periods that the development of the present phanerogamic flora of Europe has taken place. Generally speaking it may be said that during the first three periods the plants which now constitute the flora of Central Europe succeeded in establishing themselves in the area, while during the last three periods they acquired their existing distribution. This statement is true of the halophytes as well as of the phanerogams in general.

In considering first the phanerogams which colonised Europe during the cold period, it may be said that it is quite uncertain whether any of the colonists entering Europe at this epoch already possessed the halophytic modification and have preserved it ever since. But it is at least certain that this character was acquired by certain groups of individuals of two species of *Artemisia* (*A. rupestris* and *A. laciniata*) which at the time of their entrance into the area were not halophytes. Both these species probably either came from the Arctic, or from the higher mountains of Middle Asia. At the beginning of the cold period they were probably widely distributed over Europe, but their area was greatly diminished by the heat of the first hot period, and during the height of this period they probably persisted only in the vicinity of the Baltic, the Saale region, and, in the case of *A. laciniata*, also in Lower Austria. The individuals found in the latter two regions had acquired a certain amount of adaptation to salt-bearing regions, and were saved from extermination by this adaptation. The adaptation acted in two ways. First, it saved them from competition, salt-bearing ground being fatal to most plants. Second, the peculiarities possessed by halophytes are such as to diminish the loss of water by transpiration, and this would lessen the risk of death from drought in the dry and hot summers of the hot period. The following cool period with its excess of precipitation was very unfavourable to the plants, and eliminated them from all but salt-bearing regions. In the next hot period they began to spread once more, though probably but slowly, but lost the ground gained as the climate once more became cooler, the result being the development of their present limited distribution. In the region of the Baltic a somewhat different change took place. Here the plants did not become halophytes, but developed along somewhat similar lines in becoming adapted for life on a dry limestone soil. In this way again they saved themselves from excessive competition and became fitted for the steppe-like climate of the hot period. Like their halophytic allies, the Baltic forms extended their area during the second hot period, but this extended area was, as it were, broken into fragments by the cooling of the climate, and thus was produced the discontinuous distribution now so characteristic of these forms.

Another group of halophytes has originated in another way, which may be exemplified by the history of Sea-buckthorn (*Hippophaes rhamnoides*), one of the plants capable both of growing on salt-bearing ground and on salt-free ground. This plant had its original home in the high mountains of Middle Asia, but before the beginning of the fifth glacial period had established itself in the Alps. Thence during the fifth period of cold it spread over the low grounds, retreating towards the north with the ice as the climate grew warmer. It thus spread itself over the whole Scandinavian peninsula at first, but gradually lost ground as the climate grew hot during the first hot period. As the first hot period waned, it travelled down the mountain-sides, following the courses of the streams, and reached the network of lakes which then occupied the basin of the Baltic. As already mentioned, some of these lakes were salt, and it was probably on the margin of these that the buckthorn first acquired its halophytic characters. From the interior of the Scandinavian peninsula it was probably ousted less by climatic change than by the agency of the pine, which probably reached the region during the second hot period. After the acquisition of the halophytic characters, the buckthorn spread along the coasts of the Baltic and North Sea, partly by the agency of birds. Besides spreading northwards at the end of the fifth glacial period, the buckthorn reascended the Alps, though not to the great heights, and here became adapted to stony and sandy ground. From the slopes it descended along streams bordered by suitable soil to parts of the level ground.

The plants belonging to the two groups discussed above were represented in Europe during the last cold epoch, but many of the halophytes of Europe must be descended from plants which did not enter the area till the close of that period, or rather during the course of the subsequent hot period. The hot periods would indeed be peculiarly suitable for colonisations from neighbouring areas. Not only was the climate suitable during both the first and second periods, but the old flora would in both cases be weakened by the climatic changes, and little able to offer resistance to dominant immigrants. Again, as the change from the hot to the cold periods took place slowly, the immigrant halophytes would have time to adapt themselves to the change of conditions. Other halophytes again may have entered Central Europe during the cool periods from the western coast. On this coast, while Central Europe was under the influence of the last cold epoch, there would prevail a climate of insular type, with warm wet summers and mild winters. To plants growing in such localities the colonisation of Central Europe during the cool periods would be a matter of no great difficulty.

The forms which entered Central Europe during the hot periods can be divided into two sets: (1) those which grow now in Hungary, and grew there during the last cold epoch, and entered Central Europe from that region; and (2) those which cannot have entered Central Europe through Hungary, for they do not now grow there and probably have never done so since the beginning of the migration of the species.

(2) The plants which entered Central Europe during the hot period but not *viâ* Hungary number only five, namely, *Obione pedunculata*, *Cori-*

spermum intermedium, *Echinopsilon hirsutus*, *Capsella procumbens*, and *Linaria odora*. The first of these may be taken as the type of the group. It grows in the Baltic region, in scattered localities on the coast of North-western Europe, and in parts of Russia and Asia, and in the Saale salt-bearing region. It probably entered Europe from Central Asia during the hottest part of the hot period, being carried by the agency of birds. Its first station was doubtless the margin of one of the salt lakes which then filled parts of the Baltic basin. Once thoroughly established here it apparently succeeded in spreading also to parts of the seashore. In inland Europe it occurs only in the Saale region, and it must remain uncertain whether it reached this district direct from the east, or from the Baltic region, or from the shore of the Atlantic. At the close of the first hot period the plant no doubt disappeared from the Baltic area, as this became filled with fresh water, but it persisted on the margin of the North Sea, and from this spread once again into the Baltic region when that again became filled with salt water.

Hardly more numerous than the members of the previous group are (1) the plants which entered Europe during the hot period from Hungary and the neighbouring lands. As an example may be taken *Melilotus dentatus*. It is one of the halophytes which can thrive alike on ground rich or poor in salt, and doubtless during the hot period spread itself over Central Europe on both types of ground. It entered the area not only from Hungary but also through Southern Russia, Moravia, Bohemia, and so forth. It thus swept forward in all directions towards what is now the coast of the North Sea and Baltic. During the first cool period it lost most of the ground thus gained, and in the inland regions persisted only where the presence of salt in the ground gave it an extra chance. On the margin of the North Sea it disappeared almost entirely, and became limited in extension on the coast of the Baltic. During the second hot period it recovered some part of its former range, and thus acquired its present distribution.

More numerous in individuals than either of the two preceding groups is that which includes the plants which entered Central Europe during both the hot and the cool periods, and which especially migrated from the coast inland during the cool periods. In this group are included such forms as *Beta maritima*, *Zostera marina*, *Crambe maritima*, *Cakile maritima*. The plants of this group mostly grow in Hungary, in Southern Russia, in Asia, and on the coast of the Mediterranean. Many of them doubtless inhabited Central Europe during or before the fifth glacial epoch, but were then exterminated, and only later recolonised the area. During the hot period the colonisation would take place chiefly from the south and south-east, while during the cool period it would chiefly occur from the Atlantic coast, the plants there being best suited to the insular climate which then reigned over Central Europe. It is not now possible to distinguish in detail between the groups which emigrated along these two different lines, though in some cases it seems clear that the emigrants from the west succeeded in extending their area to the extreme eastern border of the Central European region. Some of the seven species mentioned on p. 304 as peculiar (in Central Europe) to

the maritime region between the mouths of the Ems and the Schelde, are in all probability immigrants from the Atlantic coast only.

Still another group of halophytes must be regarded as having originated only during the cool periods, either because they then first entered the area, or because they originated from non-halophytic forms during these periods. Examples of this group are *Allium kochii, Silene maritima, Cochlearia danica, Armeria maritima*, and so forth. Many members of this group were represented by halophytic forms on the coast during the last cold epoch, but were exterminated during the first hot period. During the first cool period an extensive migration of forms adapted to an insular climate took place, and these spread themselves alike over the inland and coast regions. The heat of the hot period when at its maximum had an injurious effect upon these colonists, and led to a limitation of their extension from which they only partially recovered during the following cool period. The peculiarities of distribution of the plants of this group are to be explained by the climatic variations to which they were subjected after their entrance into the Central European area.

It is thus obvious that the distribution of halophytes in Central Europe is not an insoluble problem, for it is possible to trace at least approximately the history of these plants, and to show how their present distribution depends upon the oscillations which the climate of the area has undergone since the last cold epoch.

THE NYASA COAL BED.

By Rev. James Henderson, British Central Africa.

A fresh interest has recently been given to the coal bed (known now for over twenty years) on the west side of Lake Nyasa in the British Central Africa Protectorate, by the discovery, some distance inland from the lake-shore mountain slopes where it had been previously observed, of a large outcrop in the bed of the river Rumpi. This discovery came about through a native report that there was in that neighbourhood a mountain that had once been on fire, which, contrary to all expectation, turned out to be true. In 1894, while this locality was still in an unsettled state, there was a village in hiding on a ledge in the bottom of a deep, cañon-like gorge of the Rumpi river, and in the height of the dry season the villagers had kindled a large fire on a bare piece of black rock across the river from their huts. The black rock was coal. The results were a conflagration up the side of the gorge, which completely denuded it of its trees and plant covering, and smouldering fires which ate into the seams along the naked face and continued burning until well on in the rains.

The gorge where this occurred is 550 feet deep, and about five miles back from the lake. The coal is exposed along the water's edge for

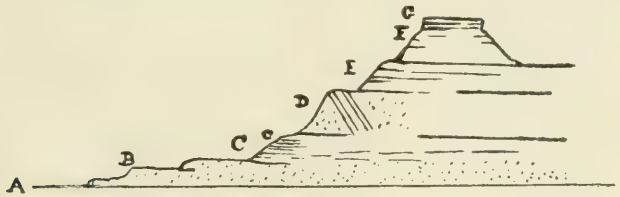
nearly 300 yards, dipping west, upstream into the river's bed. The elevation is 850 feet above the lake-level, and so over 300 feet above the outcrops previously known, the latter circumstance apparently being due to the outcrop appearing in the face of the upper side of a dislocation. Where the fire occurred coal seams are seen for nearly 80 feet up the side of the gorge from the water's edge, and for about a quarter of this height coal is the predominating element. The beds, collectively and individually, are of irregular thickness, the thickest not exceeding three and a half feet and not maintaining that thickness for more than a few yards. All the beds are penetrated, more or less, by the soft red sandstone and argillaceous matter with which they alternate. The general features of the lake-shore outcrops thus recur inland, showing that the

North-East Face of Mount Waller.

causes of their irregularity operated with a wider range than the surface appearances seemed to require. It was not the local corrugating movement which left Waller standing a solitary plateau that produced the irregularities in the Waller outcrops, but one on a much larger scale, of which no doubt the Waller corrugation was a part. The best quality of the coal occurs at the river level. It is similar to that reported before, and confirms the belief that the bed would be of some importance locally for steam and domestic purposes if such fuel were required.

The question still remains open whether there may not be seams of a thickness and quality admitting of being worked on a large scale, but the existing evidence is rather against the likelihood. The seven-foot seam described by the late Mr. James Stewart, C.E., has not been come upon again so far as we are aware. When Mr. Stewart passed up he found

the lake at a much higher level than it now is, and as there were not the present expanses of dry beach showing coal detritus at many different places, he apparently felt no necessity for locating precisely his discovery. The late Mr. Henry Drummond, who next reported on the bed, was of the opinion that Mr. Stewart's seam was a deception, as he found only "thin beds," "few of the layers" of which were "more than an inch in thickness." But as a matter of fact they were dealing with two outcrops miles apart, Mr. Stewart having struck the coal somewhere near what is now ascertained to be the middle of the bed, while Mr. Drummond, who did not travel up along the shore, but was landed in what is now Florence Bay, came upon its outmost fringe on the north side. Mr. Drummond's is an exact description at this moment for the locality he visited, and no doubt so we should find Mr. Stewart's if we could locate it; but in the latter case it may turn out that the apparent seven-foot seam is accidental, possibly consisting of two separate ones brought together

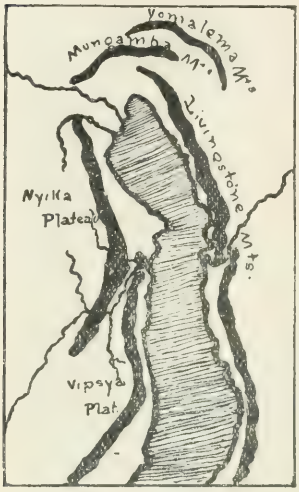


Section of Mount Waller.—*A* lake; *B* granitic base, on surface huge broken masses; *C* sandstone containing coal seam; (*c* small formation of conglomerate); *D* gneiss with small mineral veins; *E* reddish sandstone; *F* sandstone somewhat whiter; *G* dark line at summit due to lichens.

in the landslip which Mr. Stewart supposed was responsible for the position of the coal as he found it.

The formation, as now known, coincides in extent on the lake shore with the gigantic fault of sedimentary rock (the geological bearing of which was first pointed out by Mr. Drummond and later and more fully by Mr. J. E. S. Moore) which at this point intrudes through the lake's girdle of mountain ranges of gneiss and granite, elsewhere unbroken. Coal detritus first appears at the mouth of the Rukuru river, which has channelled a way for itself along the southern line of the sedimentary formation where it merges into the granitoid, and from there to the north corner of Mount Waller, a distance of about ten miles, every one of the many torrents coursing down the very steep, often precipitous, sides of the Waller corrugation washes down coal. This fault has now been traced back westwards through the micaceous sandstone, greywacké, limestone, and quartz conglomerate of the Nyika plateau, which rises in this line to 8000 feet above sea-level, and down through the grey and the red water-bearing sandstones and argillaceous formations of the great plain of the Loangwa river, where its elevation is below 3000 feet. Throughout the whole of this line (which widens greatly towards the west) the characteristics of the exposed rocks are similar, all having a

west dip with frequent lines of dislocation running nearly at right angles to the formation, producing occasionally great outcrops, visible from horizon to horizon, and gigantic vertical displacements, the Nyika plateau being apparently itself one of these, and the Mkutu range (6500), well down in the Loangwa plain, another.



To illustrate the corrugations along the north half of Lake Nyasa.

Running northwards from Mount Waller there is a lake shore plain, the part of which behind Deep Bay has had attention called to it because of its limestone formation, which is a part of the fault evidently, but in an unexpected direction. The limestone occurs in a section of it which was a small shallow lake at a comparatively recent period, and rests upon a pinkish sandstone so soft that those burning limestone have had little difficulty in chambering out their kilns with no stronger instruments than hoes and spades. This sandstone has been eroded to such an extent that what remains of the old lake floor is now a number of small, sharp, conical hills with the limestone on top, at about 100 feet above the present lake-level. But standing on one of the peaks, at the point where the limestone occurs, the margin of the old lake can be made out very distinctly to the north and east. The plain contains much granitoid debris; and a peculiar feature of it is the exposure through denudation of small seams of coal apparently re-formed from detritus. It has the appearance of having been under water for a considerable period after the movements occurred which raised the mountain wall that flanks it and to which it probably owes its own present form; it became dry land through the subsidence of the level of Lake Nyasa itself, or was raised in one of the movements of elevation and subsidence which are still going on in this region.

The river Rumpi, throughout the greater part, if not the whole, of its course, lies in the sedimentary fault. The Nyika tributaries of the Rukuru rise also in it, but make their way south into the granitoids on the border of Ngoniland, which form a prolongation of the Nyika plateau. Through these the Rukuru cuts a passage at Njakwa mountain, and then, declining to face the second granitoid corrugation, travels north-east through the Henga plain (where a prospector is said to have found gold last year) to find a channel through the sandstones, debouching alongside the Rumpi near, as we have already said, where the two formations meet.

The minerals of economical importance besides coal appearing in the fault are freestone, the limestone already mentioned, which is of inferior quality, and slate, a very promising bed of which has been laid bare in the Rukuru channel. But the main interest of it is geological, and in

that field there await a competent worker problems which seem to hold in them the key to the geological history of a large section of the continent.

THE NATIONAL ANTARCTIC EXPEDITION.

A CONSIDERABLE further amount of information in regard to this expedition has recently appeared in the daily press based upon cablegrams and letters received by the New Zealand mail. A cablegram from Captain Colbeck indicates that when he discovered the position of the winter quarters of the expedition in M'Murdo Bay, the ice prevented him from bringing the *Morning* nearer than eight miles to the *Discovery*. The transhipment of coals and provisions had, therefore, to be done by means of sledges dragged over that distance. Nor was this the only difficulty. On completion of the transhipment the distance had been reduced to five miles, showing that, in addition to the hard work of transhipment, there must have been much trouble with the ship in moving her about at the edge of the ice as it broke away.

The failure of the provisions on board the *Discovery*, the particulars of which have not yet been received, made it necessary for the *Morning* to transfer a much larger quantity of provisions than was intended, and this will entail large additional expense.

It is now clear that it would have been quite impossible for the *Discovery* to return this year. But she is only provisioned until next January, so that the despatch of the *Morning* for her relief a second time is an absolute necessity in order to avoid a catastrophe. For the additional expense a sum of £12,000 is urgently needed, £6000 this year, and the rest next year.

As will be seen from the above, the conjecture in regard to the position of the *Discovery* which appeared in our last number, p. 249, has proved correct, and the ship when left by the *Morning* was still fast in the ice. Whether or not the next season will prove more favourable than the last must at present remain uncertain, but in the latter case the *Discovery* will remain fast in the ice, and her ultimate abandonment in the Antarctic is even possible. It is, therefore, imperative that the relief ship should return, even apart from the question of provisions, for it may be necessary for her to take off the members of the party.

The New Zealand mail brought numerous private letters from the National Antarctic Expedition. With regard to the main work accomplished by the expedition up to date, the following summary by one of the scientific staff is of interest:—

"1. The discovery of extensive land at the east extremity of the great ice barrier.

"2. The discovery that M'Murdo Bay (?) is not a 'bay,' but a strait, and that Mounts Erebus and Terror form part of a comparatively small island.

"3. The discovery of good winter quarters in a high latitude—viz., 77° 50′ S., 166° 42′ E.—with land close by suitable for the erection of the magnetic observations, etc. The lowest temperature experienced was 92° of frost Fahrenheit.

"4. An immense amount of scientific work over twelve months in winter quarters, principally physical and biological.

"5. Numerous and extensive sledge journeys in the spring and summer, covering a good many thousand miles, of which the principal is Captain Scott's journey, upon which a latitude of 82° 17′ south was attained, and an immense tract of new land discovered and chartered as far as 83° 30′ south, with peaks and ranges of mountains as high as 14,000 ft.

"6. The great continental inland ice reached westwards at a considerable distance from the coast and at an altitude of 9000 ft.

"7. A considerable amount of magnetic work at sea, also soundings, deep-sea dredging, etc."

These are simply the large and principal results; there are many other minor ones.

Captain Scott writes as follows:—

"We do not seem to have done much in any one particular direction, but I hope the sum total of our labours will not be displeasing to the societies. I must make a general apology for the sketchy nature of this note, which, owing to the circumstances, has to be written in haste. When you receive it the matter will be decided, but as I write I am in considerable anxiety as to our prospects of getting out this season. It will be poor luck if we do not. We found one year's ice here last season; it broke away, and the spot remained open to the sea for at least six weeks; but we are now past the date at which it opened last season, and for this last fortnight little ice has gone out, though in the past few days there have been renewed signs of a break up. The season is evidently very bad, and the weather is getting much colder and more blustering. Under these circumstances I am getting all the stores I can from the *Morning*, hoping to send her back to New Zealand in a week or so, and to free ourselves at a later date. We shall be fully prepared for another winter, and I should not deplore it except as a waste of time. All our people remain as keen as possible. I think it would be difficult to imagine a happier or more comfortable community, considering how closely we are thrown together. If we get back this season it is my firm intention to do my best to raise money in the colonies for a third season, if the funds are not forthcoming from home. I think it would be difficult to praise Colbeck too highly for the manner in which he has followed our track, picked up our records, and found this ship; it has all worked out wonderfully well, but it must be appreciated what meagre information he had to work on, how intelligently he has followed the scent. The manner in which he and his ship's company lay themselves out to help us in every possible manner here is beyond all praise. We shall be quite comfortable, and I cannot think the harbour will remain closed for two seasons in succession."

It is thus evident that Captain Scott had been making the most strenuous efforts to get clear of the ice and return to New Zealand this year. We may be sure that, had he succeeded, we should have heard of his arrival at Lyttelton by this time, and there can now be no doubt that the expedition will be detained in the Antarctic for another year. It is hoped that during that time Captain Scott may be able to accomplish all he wanted to do, had he been able to get out and return for a third season. He modestly speaks of not having done much in any one direction, but the verdict based on his official despatch cabled some

weeks ago will undoubtedly be that the expedition has done brilliant and solid work, more, indeed, than could have been expected in one season. As already stated, much additional expense will be incurred, and before the expedition has completed its work an extra £12,000 to £20,000 will be required. It is to be hoped that the Government will see it to be their duty in the circumstances to contribute, if not the whole, at least a substantial portion of the amount required; at any rate we may feel confident that the necessary funds will be forthcoming to enable an expedition that has so well sustained the tradition of British exploring energy to complete its work.

A letter from a member of the crew gives some interesting notes on the daily life of the expedition. The writer says that seal's flesh has formed the chief part of the diet of the party, the mutton which was presented to the expedition by the farmers of New Zealand furnishing a treat for Sundays. The lack of fresh vegetables has been greatly felt. The relief ship arrived in January, and all hoped that the *Discovery* would then soon become free from the ice, but as already stated this hope was doomed to disappointment, and the stores had to be dragged over eight miles of ice.

The writer of the letter was a member of the advance party which prepared the way for Captain Scott's dash to the south, and he gives a vivid description of the toilsome journey over the ice, each man dragging a weight of 245 lbs. The escort reached latitude 79° 15′ south, and then parted with Captain Scott, watching his party set off south at a rate of ten miles per day. The escorting party then returned to the ship, the distance covered on the return journey being 110 miles, owing to the necessary detours. On the outward journey they made an average of seven to eight miles a day, but on the return, with the lighter load, an average of ten miles a day. On the return the relief ship was in sight, and soon after the captain's party was observed approaching the ship. They returned without any dogs however, all these having been destroyed on the journey, on account of the food-supply going bad. As a result the exploring party had to resort to the fatiguing practice of relay journeys, so that they only accomplished two miles a day, in place of the six expected. On the return journey, as already noted, Lieut. Shackleton became ill, and in consequence Dr. Wilson and Capt. Scott had to drag a load of about 270 lbs. each, while a considerable part of the equipment had to be discarded. In all the exploring party travelled 800 miles.

Among some other interesting details given may be mentioned the fact that the expedition experienced 123 days without the sun, and 104 days of complete darkness. The lowest temperature registered was 58° below zero (or 60°?, cf. p. 315), but the members of the expedition are stated not to have felt the cold to any great extent when the air was still, but the blizzards were terrible.

On May 10th, the New Zealand Shipping Company's steamer *Paparoa* arrived at Plymouth bringing home a member of the *Discovery's* crew, and also a member of the crew of the *Morning*. The *Paparoa* was

in Lyttleton harbour on March 25th when the *Morning* arrived from the Antarctic, and thus her passengers were enabled to gather some further details in regard to the cruise of the *Morning*.

The *Morning's* crew said that often they found the heat of the perpetual sun oppressive, and that they actually became sunburnt. It was a curious experience passing Christmas and the New Year in perpetual daylight, and at midnight to play cards on deck with the sun beating down. Later on darkness began to assert itself, and midnight was marked by faint shadows like twilight. The *Morning* reported that the *Discovery*, when she left that vessel, was snugly lying in a well-sheltered spot, and that her men were then blasting the ice to force a passage. The only bit of green vegetable seen by the *Morning's* crew on her voyage was a crop of mustard and cress grown by the officers on a wet blanket with Antarctic soil. One member of the expedition states that those on the *Discovery* had grown very thin as a result of the hardships they had undergone, and when the relief ship arrived they were in some cases almost unrecognisable, while all the men looked years older.

Little as yet has been heard of the sledging expedition carried out by Lieutenant Armitage, the second in command. The following are extracts of an account of this journey published the day before the *Paparoa* left:—

"The expedition headed by Lieutenant Armitage and Lieutenant Skelton was of great importance. In the face of great difficulties the party scaled a glacier nine thousand feet high, where, owing to the rarified air, one man suffered severely. The party had no dogs, and were, therefore, compelled to drag their own sledges. For a portion of the journey they were accompanied by Dr. Koettletz and eight men from the *Shion*. The work was terribly hard, as the sledges had to be continually unloaded, lowered down crevasses 50 feet to 60 feet deep, and hauled up on the other side. The party were roped together, but on one occasion Lieutenant Armitage fell down a crevasse hundreds of feet deep. Fortunately, his rope held, and he was hauled up uninjured."

Some further details have now come to hand in regard to the adventures of Seaman Hare which has been already mentioned (p. 249). He said:—

"It was in March last, just a year ago, that Mr. Barnes, with a party of fifteen officers and men, set out from the *Discovery*, then lying in her winter quarters, to deposit a record at Cape Crozier, to be left for the benefit of the relief ship to guide her to the *Discovery*. When the party left the vessel with a full equipment of sledges and tents, she was not thoroughly frozen in, and the sea ice was not strong enough to be used as a highway. The party had, therefore, to climb on to the land, ascending about 900 feet, and make along the land ice instead of taking the short winter route round Cape Armitage. All went well for ten days, and at the end of that time, having descended again to the sea-level, the party arrived at the foot of Mount Terror, only to find the snow too soft to allow of a further advance. In these circumstances three of the officers volunteered to go on alone, and to them was intrusted the fulfilment of the mission, the rest of the party returning in the direction of the vessel. They made good progress on the homeward journey, although the ascent to the high land again tried them severely.

They were probably not more than ten miles from home when a fearful blizzard was encountered. It was a terrible ordeal, and it soon got so bad that Mr. Barnes decided to abandon the tents and sledges, leaving the dogs to find their way back to the vessel as best they could. Leaving our belongings, we began to tramp back to the ship; but we could not see two yards in front of us—the snow was falling so thickly. It quickly piled up into huge drifts, and thus made our journey very hard. Not long after we started I got separated from the rest of the party, and was lost. I can remember wandering about for a long time trying to get on the right track for home. But I could not make out where I was, and in the howling storm I became thoroughly exhausted. I must have fallen down out of sheer weariness and gone straight off to sleep in the snow. I heard afterwards that on two succeeding nights they sent out search parties after me, but could not find me; and it is not to be wondered at, for I was lying asleep under the snow all the time. After the second attempt they gave me up for lost, thinking I must have succumbed to exhaustion and been buried in a snowdrift. That is just what did happen. But I was buried alive and not dead, and somehow or other I remained alive. On the second day I woke up some time in the morning. Probably it was pretty early. The warmth of the sun soon revived me, and by the time I was fully awake I had begun to understand where I was and what had happened to me. I thought it must be Wednesday morning, as I had been lost on Tuesday afternoon; but, beyond feeling rather hungry, I was all right. I looked round me, and soon discovered the vessel; and I did not lose much time in starting out for her. When I arrived all on board got a great surprise, and the doctor was amazed at my appearance. They told me what day it was, and then I found out how long I had been lost. It must have been forty-six hours from the time I lost myself until I reached the ship; and I suppose I was asleep for thirty-six hours. The doctor said it was a miracle that I should ever have got through it alive. When they could find no trace of me on the Wednesday, he was sure that I would never be seen alive again. I suffered no ill effects. In fact, I did not even get a frost-bite, and that puzzles the doctor more than ever. It was a wonderful experience, but I don't want another of the same sort. Mr. Barnes got frightfully frost-bitten during the blizzard, and suffered for a long time afterwards. The place where I was asleep was only about four miles from the ship; but it was easy enough to get lost, because we had not been there long enough to know much about the land."

Vince, the seaman who was lost, was a member of this expedition, and concerning his death Mr. Hare said:—

"Vince and the three others seem to have got away by themselves, and made off in the right direction. About four miles from the ship there was a long slope to be descended, and they reached what they thought was the edge of it, and began the descent. They had gone about half a mile, almost blinded by snow all the time, and unable to see where they were going, when Vince suddenly disappeared, apparently falling straight down, only a yard or two in advance of the rest of the party. Then they discovered that they were on the edge of a huge precipice, over which Vince had fallen, the others narrowly escaping the same fate. We had only been about a month in our winter quarters then, but the three survivors remembered enough of the locality to know that they had come down a wrong slope, which ended in a yawning precipice some three and a half miles from where the *Discovery* was lying. They retraced their steps at once, and getting on to the right track, reached the vessel about nine o'clock in the evening. That was

on a Tuesday, and it would be about four o'clock in the afternoon when Vince was lost. As soon as the three men reached the ship they reported the accident, and the gale having moderated, search parties were at once sent out. They could find no trace of the missing man, and on the following day they were still unsuccessful. No other conclusion could be come to than that Vince had been drowned. If it had been later in the year there would probably have been no fatality, for the vessel would have been frozen in and we would have found Cape Armitage on the barrier ice instead of having to come overland."

In the course of a letter written by Mr. Bernacchi dealing with some of the magnetic work, that gentleman says:—

"Our record of 82° 17′ and the discovery of so much new land will take some beating. Scientifically a great deal has been done. All the international term days have been kept. The curves are unique and of a most interesting nature. The very large annual variation in the element is, perhaps, the most conspicuous thing. But it is the individual curve itself that is so interesting. I have never seen anything like it. We have now something like four hundred magnetograms. The term days were a perfect nightmare in the winter, when one had to go over from the ship to the variation observatory in a howling blizzard and the temperature many degrees below zero. I was lost once for some hours while returning from one of these excursions. It will interest you to know that our curves for April 10th and 11th are about the most disturbed for the whole year. One of the most typical of the magnetograms for the year 1902-3, with data for reduction, has been sent home in case something should happen to us before the return of the expedition. The seismograph has been working the whole year, but very few shocks and tremors are recorded. Our largest are on May 25th and on September 22nd, which seems to correspond with your record on April 18th. There are some irregularities in the line which might be due to the Guatemalan earthquake. There are some tremors, however, which coincide with your record. From October 3rd to October 8th a great many tremors were recorded. I also have a year's observations of atmospheric electricity."

Regarding the voyage of the relief ship, Captain Colbeck reported that on Christmas day last, three weeks after sailing from Lyttleton, he crossed the Antarctic Circle, and on that day two islands were discovered. On January 3rd Victoria Land was sighted, and a blizzard sprang up that lasted for six days. On January 8th a landing was effected at Cape Adare, a precipitous basaltic rock, 3700 feet high. Proceeding through heavily packed loose ice, a party landed at Possession Island, which was covered with penguins. Those on the *Morning* stated that the birds had made a wide track to the centre of the island, having removed the larger stones from the paths, which by long usage had become quite smooth. South of Possession Island was closely packed with ice, which in the neighbourhood of Woodbay and Coulman Island was especially heavy. On January 14th a landing party left a record at Franklin Island, and four days later letters from Captain Scott, which had been deposited at Cape Crozier, were taken off. Three days after this, on January 23rd, the *Morning* having forced her way through the ice-pack, sighted the *Discovery*, which was separated from the relief ship by no less than ten

miles of fast ice, and on the following day, by means of sledges, the two Antarctic expeditions met. By February 26th, owing to some of the ice having broken away, the distance separating the two ships was reduced to five miles, but not even the heaviest gales had the effect of further breaking up the intervening icefields.

The *Morning* bade adieu to the *Discovery* on March 2nd, when she steamed out of the ice on her return to New Zealand, having transferred to Captain Scott's vessel under circumstances of great difficulty the stores, clothing, and coal to the *Discovery*. She had none too much time to get clear of the ice, and had she remained longer she, like the *Discovery*, would soon have become shut in.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a meeting of Council held on the 27th April, Mr. George Allan Cadell was elected a member of the Society.

At the same meeting it was resolved to confer the Society's medal on Captain Otto Sverdrup in consideration of the discoveries made by his Arctic Expedition during the years 1898-1902.

Meetings in May.

On the 4th May, in Edinburgh, Captain Otto Sverdrup read a paper on his Arctic Expedition of 1898-1902 in the *Fram*. The Chair was occupied by Sheriff Charles J. Guthrie, K.C., who, after introducing Captain Sverdrup, said that interested though those present were in Arctic exploration, they had interest also in another expedition now going on at the opposite end of the world, namely, the Antarctic expedition under Mr. Bruce. Money was wanted to the extent of £2250 for the first year, and for the whole expedition of two years nearly £10,000. That seemed a large sum, but they did not despair of its being got. It would be a very great misfortune if that expedition should come home before it had fully accomplished its object. They could not expect Government to provide the funds. When Captain M'Clure, who went round the North-West Passage, came home, he got a knighthood and a vote of £10,000. But that could not be expected. The money must be found by private enterprise. They would be interested to know that Captain Sverdrup's expedition was due to the generosity and patriotism of Mr. Axel Heiberg and the Messrs. Ringnes, and he hoped there were Scotsmen who would take that example to heart and cheer Mr. Bruce and spur him on by the knowledge that the funds which were so urgently wanted had been obtained. The Chairman then presented Captain Sverdrup with the silver medal of the Royal Scottish Geographical Society. As would be seen from the fact that he was wearing the Grand Cross of the Order of St. Olaf and other orders,

this was not the only honour Captain Sverdrup had received. In this country we were somewhat sparing of decorations for men who did such work, but in his own country of Norway from the hands of his own King, he had received recognition of his great achievement. The medal was the highest honour the Society had to bestow.

Captain Sverdrup replied in Norwegian, which was interpreted by Mr. Currie, who said:—"Mr. Chairman, Captain Sverdrup requests me to convey through you to the Royal Scottish Geographical Society his sincere thanks for the honour they have done him in bestowing upon him their silver medal; and he thanks this meeting for their very kind reception. It is a double pleasure to him," he adds, "to receive this recognition of his work from a nation which has always been foremost in geographical exploration, which has at all times taken so deep an interest in Arctic discovery, and which has been able to show such brilliant results for its labours in these regions."

After the reading of the paper, which will appear in a subsequent number of this *Magazine*, Captain Sverdrup was cordially thanked for it, on the motion of Colonel Wardlaw Ramsay.

Mr. Bruce's Antarctic Expedition.

The Secretary has received the following donations to the funds of the Expedition, viz.:—

Mr. Robert M'Vitie, . . .	£50	0	0
Mr. John Rutherford, W.S., . . .	5	0	0

OBITUARY NOTICE.

Paul Du Chaillu: born 1835; died April 29, 1903.

Late on the evening of Wednesday, April 29, this distinguished traveller died in the Alexandra Hospital at St. Petersburg, after an illness of only some hours' duration.

Paul Du Chaillu was born, according to one account, at Paris, and according to another, at New Orleans; his earlier years at least were spent in Paris. His father held an official post in the French settlement on the Gaboon river on the west coast of Africa, where he was also engaged in commerce. While still very young the future traveller joined his father in the colony, and was there educated at a Jesuit institution. Here he acquired considerable familiarity with the native language and customs, and was inspired by his teachers with a passion for travel. When seventeen years of age, young Du Chaillu, who had entered his father's business, was sent to New York with a cargo of ebony. While there he contributed a series of articles on the Gaboon country to the *New York Tribune*, which at the time attracted not a little attention. In New York he remained for three years, becoming naturalised as an American citizen. At the end of the three years, when only twenty

years of age, he sailed from New York to begin his first journey of exploration in West Africa. The journey occupied nearly four years, and during it the young explorer had no white companion, and travelled partly on foot, and partly in canoes. He covered a distance of about eight thousand miles, shot and stuffed over two thousand birds, and killed more than a thousand quadrupeds. By far the most important of his finds was the gorilla, specimens of which were purchased from him by the British Museum. It is, however, incorrect to say, as is sometimes done, that Du Chaillu discovered the gorilla. Apart from the early, somewhat indefinite, allusions to the animal, Dr. Savage, an African missionary, sent skulls of the gorilla to Sir Richard Owen in 1847, while in 1851 a Captain Harris sent a complete skeleton to London. But Du Chaillu's specimens were the first entire animals known to Europeans, and Du Chaillu, according to his own statements, was the first European to see a living wild gorilla in its native haunts. This was, however, one of the points over which fierce controversy raged when the explorer returned to civilisation. The results of the four years' exploration were published in 1861 as *Exploration and Adventures in Equatorial Africa*. As already indicated, the book, while it roused everywhere keen interest, was much criticised. Du Chaillu's scientific equipment was meagre, and both his geographical and zoological observations were strongly questioned. As the result of the controversy, he resolved to return once more to the scene of his labours, preparing himself by a course of scientific study, and providing himself with such scientific instruments as would enable him to demonstrate the accuracy of his previous statements. He sailed from England on this second expedition in August 1863. Unfortunately, however, he lost much of his equipment by the swamping of a canoe, and had to send to England for a fresh supply. During the interval he made some minor excursions, and ultimately spent two years in traversing unknown country. At the close of this period he came into conflict with the natives, and was obliged to return to the coast minus his collections, though fortunately in possession of his journals. The results of this expedition were given to the world as *A Journey to Ashango Land* in 1867. The book did not create so great a sensation as its predecessor, but was an important contribution to scientific geography. With regard to the controversies aroused by the explorer's first volume, it is sufficient to state that his accuracy in essentials was established by his own and other subsequent observations.

After the second African expedition, Du Chaillu spent some years as a lecturer in both Europe and America, and attained much success in this capacity in both continents. Subsequently he spent some time in the study of the more remote parts of Norway and Sweden, publishing his results as *The Land of the Midnight Sun* (1881) and *The Viking Age* (1887). The latter deals with the early history, habits, and customs of the English-speaking nations. The African expeditions also furnished material for a number of books of a popular nature, intended primarily for the young, such as *Stories of the Gorilla Country* (1868), *Wild Life under the Equator* (1869), *Lost in the Jungle* (1869), *My Apingi Kingdom* (1870), and *The Country of the Dwarfs* (1871).

At the time of his death M. Du Chaillu was engaged in the study of peasant life in Russia, having with characteristic energy learned Russian for the purpose. The result of his work was to have been embodied in a book similar in type to *The Land of the Midnight Sun.*

Though short and thick-set in person, M. Du Chaillu was extremely strong and resistant to fatigue. He enjoyed admirable health, and was remarkable for his personal courage and nerve in the presence of danger.

GEOGRAPHICAL NOTES.

EUROPE.

Marine Biological Association of the West of Scotland.—We have received both the Annual Report of this Association for 1902, and also a "Statement with regard to the Endowment Fund." The report shows the extent to which the resources of the Millport Marine Biological Station are being increasingly utilised, not only by students engaged on special problems, but also by teachers who have brought down their classes, and by scientific societies. Though the work of the station is not primarily geographical, yet a large part of its function is to stimulate interest in the study of nature, and this is an aim which is identical with that of the scientific geographer. We cannot, therefore, refrain from wishing the Association all success in its efforts to improve and extend the station and place it on a more satisfactory basis. The pamphlet on the Endowment Fund contains a reprint of an address delivered by Sir John Murray to the Association on March 12, 1903. In this address Sir John gives an account of the history of the Association and of the Marine Station at Millport, and of the future plans of the committee. The Millport Station possesses the almost unique distinction of having been founded and maintained entirely by private effort, and the committee feel that now, after it has justified its existence by six years of steady work, it is time to attempt to place it upon a more satisfactory basis from the financial point of view. They aim at obtaining an endowment fund of £25,000, which at present rates of interest would provide an income of about £750. This income would cover about half the estimated expenses of the station: the remainder would, it is expected, be raised by fees paid by workers, annual subscriptions, and so forth. Members of the Royal Scottish Geographical Society interested in the progress of Marine Research in Scotland, or in Nature Study generally, should communicate with the Hon. Secretary of the Association, Mr. John A. Todd, B.L., C.A., 190 West George Street, Glasgow.

Antwerp Geographical Exhibition.—The recent issue of the *Bulletin de la Société Royale de Géographie d'Anvers* (T. 26, fascic. 3) is devoted to a full report of the Exposition Cartographique, Ethnographique, et Maritime, which, as already noted in our pages, was held at Antwerp last year during May, June, and July, and proved most successful. Nineteen countries took part in the exhibition, and there were 310 exhibitors and 3348 exhibits. Of special interest was the ethnological department, where the collections representing the Congo Free State attracted great attention, while the East Indies were also well represented. The missionaries of the Sacre-Cœur de Borgerhout contributed an admirably arranged and classified collection of objects illustrating the ethnology of the inhabitants of Oceania. The other sections were also well filled, and the whole exhibition

proved most instructive, and is likely to have promoted the scientific study of geography by showing the scope and interest of the subject.

ASIA.

Expedition to Mesopotamia.—A Reuter message from St. Petersburg announces that the Imperial Russian Geographical Society will send a scientific expedition into Mesopotamia during the year. The expedition will be under the leadership of M. Kaznakoff, and will include among its members M. Alferaki, zoologist, and M. Tolmatcheff, geologist.

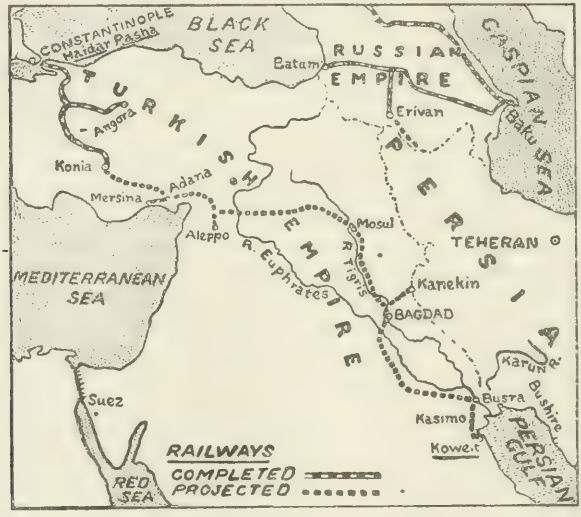
Cause of Leprosy.—Mr. Jonathan Hutchinson has recently returned from a tour in India undertaken for the purpose of studying the relation between leprosy and fish-eating. It will be remembered that the Prince of Wales's Committee, which studied the question eleven years ago, decided against the fish hypothesis on the ground that many lepers in the asylums denied having eaten fish. Mr. Hutchinson considers that there are no facts which controvert or render untenable the fish hypothesis, while there are some which afford it what seems to be unassailable support. As regards the statement that many lepers have never eaten fish, it must be remembered that the disease is communicable through food, so that food prepared by the hands of leprous persons would give the disease to persons partaking of it. In other words, though fish-eating is the invariable originating cause of leprosy, it is not the sole cause of its prevalence. Some of the statistics which Mr. Hutchinson quotes are very striking. Of special interest is the large proportion of cases among the "Salsette Christians." This term is applied to the converted natives of the little island of Salsette, just north of the city of Bombay, and now connected with it by a roadway. It has a population of 50,000, very largely engaged in fishing and fish-curing. The Salsette Christians are all Roman Catholics, and are the descendants of converts made by the Jesuits in the time of the Portuguese occupation. Not only do they observe the fish fast-days of their Church, but almost all of them are actually engaged in the fish trade. It is to be noted that, during the eight years under consideration, no other Christian community in the Presidency supplied a single leper to the Matunga asylum. They all came from this small, but very specially constituted, population. A number of similar cases might be quoted showing the relation between the habits of any group of people as regards fish-eating, and the percentage of lepers.

The Re-creation of Chaldea.—Under this title Sir William Willcocks delivered a lecture at Cairo in March of this year, the object being to show the possibility of restoring the ancient irrigation works of the Tigris, and so reclaiming an enormous stretch of land in the delta which is now sterile. The Tigris enters its delta at a point near the site of ancient Opis, and deposits all its coarser material within the first 250 kilometres. Though the delta as a whole cannot be compared with that of the Nile, yet these 250 kilometres are extraordinarily fertile, and were once fully irrigated and utilised. In ancient days Opis was the head of two great canal systems, which irrigated respectively the right and left banks of the Tigris. Though ruined, both systems can be still made out; that on the left bank was the Nahrwân system, that on the right the Djeil. The former was an enormous canal, in many reaches attaining a depth of 5 to 10 metres, and a width of 100 to 120 metres. Both systems were ruined by the Tigris leaving its original course, and destroying parts of both canals in the change. With modern resources there would be no difficulty in reconstructing the canal systems, and Sir William Willcocks is of opinion that, especially if the works were carried out in conjunction

with the Bagdad railway scheme (see below), it would be possible to make the undertaking a huge financial success. He estimates that a million and a quarter acres of land could be reclaimed at a cost of about £8,000,000, and the land so reclaimed would be worth £30 an acre. In addition, the land between the Tigris and the Euphrates and between Bagdad and Babylon is also capable of reclamation.

Bound up with the lecture is an appendix containing information in regard to the meteorology of Bagdad, and also an address entitled "Egypt fifty years hence."

The Bagdad Railway.—The accompanying sketch map illustrates the path of the projected Bagdad Railway, which has received a considerable share of public attention of late.



AFRICA.

Egypt and the Sudan in 1902.—A Parliamentary paper (Cd. 1529) containing reports by His Majesty's Agent and Consul-General on the finances, administration, and condition of Egypt and the Sudan in 1902 has just been issued. Lord Cromer opens his report on Egypt with a review of the financial situation. He remarks that the main feature of the budget for the current year is the abolition of the octroi duties at Cairo and Alexandria, involving a revenue loss of £E230,000. Recent events, says Lord Cromer, had strengthened the arguments already existing in favour of their abolition, and he is of opinion that the Government has done wisely in placing fiscal relief before the more rapid progress in urban improvement which would have been possible had the duties been retained.

Lord Cromer next refers to the projected Suakin-Berber railway. On this he remarks:—"I have occasionally heard it suggested that the construction of a railway to Suakin will be detrimental to Egyptian interests, for that the trade, which would otherwise come down the Nile to Alexandria, will be diverted to the Red Sea. In my opinion, it is a sufficient answer to this plea to state that it is generally undesirable, and almost always in the long-run impossible, to force trade

into an artificial channel. A glance at the map is sufficient to show that the ports on the Red Sea are the natural outlets for the trade of the Sudan. Apart, however, from any considerations of this nature, the plea that the construction of the Suakin-Berber railway will be detrimental to Egyptian interests may be proved to be fallacious. The interests of Egypt require that the Sudan should be rendered self-supporting with as little delay as possible. It cannot be doubted that the construction of the Suakin-Berber railway will constitute a distinct step in this direction. If the customs receipts at Suakin increase, Egypt will profit, for a diminution of the Egyptian contribution towards the expenses of the Sudan will be rendered possible. More than this, it is in the main not a question of taking trade away from Alexandria and transferring it to the Red Sea ports. It is rather a question of creating a new trade which does not now exist, and which, unless the Suakin-Berber railway is constructed, probably never will exist. It is true that such articles as gum and ivory, of which the production is limited, can be exported at a profit by the Nile route, though, in the case of gum, the trade could probably be increased if the cost of freight were diminished. But it is almost hopeless to expect that any staple article of general production, such, for instance, as cotton, can be produced in the Sudan and sold at a profit in the markets of Europe, if it is to be weighted with the cost of freight from Khartoum to Alexandria. In fact, the very long journey by rail and river must of necessity go far to stifle, not only the export, but also the import trade; whilst as to the internal development of the country, it is only necessary to cite one figure in order to show how much it is retarded by the absence of railway communication with the Red Sea. I am informed that at this moment a ton of coals at Khartoum costs £4. Under these circumstances there can, I venture to think, be no hesitation in concluding that the construction of the Suakin-Berber railway will be most beneficial, not only to the Sudan, but also to Egypt."

Then follow Lord Cromer's separate observations on the various departments of administration. He says that the Agricultural Bank which was started last June, though it is as yet only well known in parts of Lower Egypt—Upper Egypt having hardly been touched—has afforded an assistance to the *fellaheen* which has been greatly appreciated. Passing on to the question of railway administration, he expresses his opinion as decidedly adverse to the transfer of the Egyptian railways to a private company. The goods tariff on the Egyptian railways has been carefully considered for purposes of revision, and it is hoped that in the course of the year a new edition of the tariff, meeting all reasonable requirements, will be issued. In Egyptian trade there was a decrease of £E438,000 in imports, the total being £E14,211,000; exports, however, rose to £E17,617,000, an increase of £E1,887,000 on 1901. The decrease in imports is accounted for mainly by the low prices which have prevailed in foreign markets throughout the year for certain important articles, and the large decrease in the importation of cereals and flour, due to a good Egyptian crop. The cholera epidemic also caused a general trade depression while it lasted.

Lord Cromer deals at some length with the question of irrigation projects on the Upper Nile, pointing out that with the construction of the great dams at Assuan and Assiut the general irrigation programme is approaching completion, and that for many reasons it is desirable there should be a pause. He observes that the question of utilising Lake Tzana as a reservoir lies still in a comparatively remote future; that as yet Sir William Garstin has not come to a decision on the engineering problems involved, that the financial aspects of the case have then to be considered, together with political considerations.

South African Scientific Expedition.—A Reuter telegram from Cape Town states that Dr. Rubin left on April 29 for Chinde, with an expedition numbering two hundred and eighty persons, for the purpose of measuring an arc of meridian into North-Eastern Rhodesia, from the Zambesi to Lake Tanganyika. The expedition will be away three years, and is expected to yield important data in connection with the determination of the earth's dimensions.

The Sources of the Nile.—Sir W. E. Garstin, who has just returned to Cairo, covered 7000 miles in the course of his journey, of which 700 miles were accomplished by marches on foot. Two of the four Englishmen who started with him had to abandon the trip owing to malaria. His object was to study the sources of the Nile supply, and to obtain information on the spot regarding the rivers which unite to form the White Nile.

He visited the Victoria Nyanza and the main source of the Nile at Ripon Falls, thence made his way over to the Albert Edward Nyanza, following its northern shore to the headwaters of the Semliki river, and again visiting the latter at a point north of the Ruwenzori chain. Lastly, Sir W. Garstin arrived at the Albert Nyanza and the Victoria Nile, eventually proceeding down the Bahr-el-Ghazel *viâ* Wadelai and Dufile to Gondokoro, where he embarked on board a steamer and returned by the White Nile to Khartoum.

The information which Sir W. Garstin obtained will eventually be published in a report. The measurements made by him confirm the fact that over fifty per cent. of the water passing through Lado is lost in the marshes between Lado and Lake No.

Exploration in North-East Nigeria.—Captain J. K. Cochrane, Military Resident in Bornu, has recently returned from the Lake Chad region after a remarkable journey, lasting three months, over portions of the British Protectorate never before visited by a British officer. Captain Cochrane's narrative is as follows:—"I left the post of Maiduguri to the south-east of Lake Chad in November last with an escort of forty men, and proceeded along the direct road to Kuka. *En route* I stopped three weeks at Mongornu—the temporary capital of Bornu—in order to assist at the disarming of the Sultan of that province. Mongornu, which has for the time being replaced Kuka as the capital, was a mere hamlet last year when the British came through to Lake Chad, but since then it has grown tremendously, and the population has risen from 50 to between 25,000 and 30,000. At the end of the next rains the Sultan will commence to rebuild the former capital, now nothing but a ruin overgrown with bush. From Mongornu I went to the shores of Lake Chad and next to Kuka, and thence through waterless forest to Yo, the great port for caravans from Tripoli. The whole country had been devastated by the Tubus, the warlike race from the Sahara, who were continually raiding the British sphere. Yo—formerly walled like Kuka—was also a ruin. Owing to the ravages of Rabah's people only one Arab caravan had passed through since 1892. I hope that as a result of the British occupation confidence and prosperity will be restored. From Yo I again proceeded to the Chad shore, and found the source of the great unnamed river which runs all the way from the lake to Kano. The river was at this time 300 yards broad and 2 ft. 6 in. deep, but in the dry season all the water disappears, and the natives have to dig in the sand for it. The population was an industrious agricultural one, but all were terror-stricken as the result of Tubu raids. Crossing the river, we discovered two very large and densely populated towns unmarked on the map, each with a large cultivated area. One of these, named Kabi, had a population of 3000, while the second, called Buddam, had 5000 inhabitants. I got into touch with the people here, who were

most anxious for British rule. The country was beautiful, resembling the Sussex Downs, and was covered with cattle, sheep, and ostriches. At Alaune, a ruined town, I first met the Tuareg, who were in great force and had with them 6000 camels. All were well armed, and I was struck by the appearance of the Tuareg girls, who rode their camels astride. I had as companion a brother of the Sultan of Zinder, who knew these Tuaregs, and perhaps it was this fact that prevented them from attacking us. Later, we discovered on the edge of the desert a chain of salt lakes. The country was a treeless desert, without a sign of life anywhere. After marching south we arrived at Gujba, whence I returned to my post at Maiduguri at the end of January."

AMERICA.

Reconstruction of Galveston.—A remarkable testimony to the courage of the American people is afforded by the energy with which the terrible disaster of September 1900 at Galveston, Texas, has been so far as possible repaired. It will be remembered that at the date mentioned the greater part of the city was overwhelmed by the sea, causing the loss of some 10,000 lives. Along with other property the works which were in process of construction on behalf of the Southern Pacific Railroad Company were destroyed. Fortunately for the city, the company determined to reconstruct, and at the request of the authorities concerned, it has also undertaken the erection of a sea-wall, 17,600 feet long, and rising to a height of 16 feet, which is estimated to cost 1,300,000 dollars. It is expected that this wall will prevent any repetition of the disaster of 1900. Further, the entire city of Galveston is to be raised a height of 10 feet, the State of Texas having agreed that for a period of seventeen years the city shall appropriate to the cost of this work—estimated at 3,000,000 dollars—the money which it would otherwise pay to the State in the form of taxation.

The Recent Eruption of the St. Vincent Soufrière.—Mr. H. Powell, curator of the St. Vincent Botanic Gardens, reporting to the Imperial Commissioner of Agriculture on the serious eruption of the Soufrière on Sunday, March 22 last, states:—"The cloud of stones, ashes, etc., was of stupendous size, and rose to enormous heights, somewhat similar to those of May 7 last. The noise on March 22 was, however, far less than on May 7, and the electric display was very little. At 11.30 A.M., and again at 12.30 P.M. on March 21, huge volumes of vapour were seen ascending from the crater, and at about 6.30 on the morning of March 22 the serious eruption began, and continued during the morning and most of the afternoon. At 9 A.M. on March 23 there was another huge outburst. On the 22nd a slight layer of dust fell at the botanic station, and the northern half of the heavens was shrouded in gloom, but there was no real darkness. The cloud of dust was seen going in the direction of Barbados, so that the cable news of darkness occurring in that island did not come wholly as a surprise. Hall, the man in charge of the experiment station at Georgetown, has informed me that very serious damage has been done to experiment plots there. He reports having carefully measured the new ejecta there, and finds it about 3 in., with numerous stones the size of one's fist. At Touarmina 5 in. of ejecta are reported, but at Colonarie the layer is said to be light." Although the surface wind was from the east, the dust-cloud mentioned above from the eruption at 6.30 A.M. on March 22 reached Bridgetown, Barbados, one hundred miles to eastward, by 9 A.M., so that its rate of motion was not less than forty miles an hour after having attained an elevation of probably three miles at least above the Soufrière. Its altitude above Barbados was estimated at about 8000 feet, or double the height of

the Soufrière. At several points the first fall of dust was observed at 11.15 A.M.; it increased until 1.30 P.M., then diminished, and by 5 P.M. it had ceased. In the neighbourhood of Bridgetown the fall was at the rate of about $2\frac{1}{2}$ tons per acre; considerably less at Bathsheba, fourteen miles to the north-east; while at Codrington House, two miles north of the town, it amounted to 6·52 tons per acre. Taking 3 tons per acre as the average would give 300,000 tons for the whole island. The May dust was a very light grey, that of March very dark—almost black, Dr. Spencer describing the March dust-cloud as of a deep Prussian blue colour.

It may be noted that in the *West Indian Agricultural News* for March 14 there is a descriptive account of experiments which have been commenced on the island of St. Vincent with the view of testing the possibility of starting cultivation, with certain plants, on estates which are buried under from nine to ten inches of volcanic ash, resulting from the severe eruptions of the Soufrière in May, September, and October 1902. The plants selected for the experiments are sugar-cane (five varieties), cotton, ground-nuts, arrowroot, and sweet potato. The experiments were started in January, and valuable results were expected, "provided there were no further eruptions." It is to be feared, therefore, that the great quantity of ash thrown out from the Soufrière during the eruption of March 22 will greatly interfere with the interesting investigation (see Mr. Hall's report above).

AUSTRALASIA.

Australian Transcontinental Railway Schemes.—A board of five leading engineers, representing the five states of the Commonwealth directly concerned in the project, was appointed some time ago to consider and report upon the practicability of connecting Western Australia by rail with the eastern states of the Commonwealth. The report of the board has now been presented to the Commonwealth Government. It estimates the cost of construction at five millions, the route favoured being from Port Augusta, *vid* Tarcoola, in South Australia, to Kalgoorlie, in Western Australia. A gauge of 4 ft. $8\frac{1}{2}$ in. is advised, and it is thought that the line could be completed within four years. Assuming that the past prosperity of Western Australia be maintained, the proposed line should become a necessity and ultimately a financial success. It will expedite the delivery of the English mails in the eastern Australian cities by two days. The board recommend that the Commonwealth Defence Department be asked to supply a special report on the strategical aspects of the proposed railway, and that extensive investigations to determine the practicability of procuring subterranean water-supplies for locomotive purposes should be undertaken. At present the particulars as to possible sources of water-supply, both for constructive purposes and locomotive use, are declared to be extremely meagre.

POLAR.

French Arctic Expedition.—Some further details in regard to this expedition are now available. The first objective will be Tromsö; thence the party will steer for Spitzbergen, where a collection of fossils will be made. From Spitzbergen the journey will be continued to Barents Sea, the Strait of Matotchkin and Nova Zembla. The last-named will be traversed both along its eastern and western sides, the return being made by the Kara Sea and the Strait of Waigatch. The scientific

staff, in addition to M. Charcot, will include MM. Gerlache, chief of the Belgian Antarctic Expedition, J. Bonnier, director of the Maritime Laboratory of Wimereux-Ambleteuse, Professors Zimmermann of Lyon, and Perez of Bordeaux, M. P. Pléneau, an engineer, also a midshipman and an artist. The crew of the vessel will consist of the captain, two enginemen, and seven sailors. In case of being forced to go into winter quarters, the expedition will take provisions for sixteen months. The Société de Géographie de Paris, following the example set by the Académie des Sciences, the Muséum, and the Minister of Instruction Publique, has given financial support to the undertaking, its contribution amounting to 8000 francs.

The Swedish Antarctic Expedition.—The Swedish Government introduced a bill on May 6 granting 200,000 öre towards the equipment of a vessel to go to the relief of the Antarctic expedition under Dr. Otto Nordenskjöld. The expedition's ship, the *Antarctic*, left Terra del Fuego at the beginning of November last for its summer voyage, and should have reached Dr. Nordenskjöld's winter quarters in Snow Hill Land about December 10. She was expected to be back at Port Stanley with Dr. Nordenskjöld and the rest of the expedition about the end of February or the beginning of March.

GENERAL.

Edinburgh Summer Meeting.—A meeting for the study of Edinburgh and its region will be held this year from August 3 to August 29 under the presidency of Sir John Murray. The chief departments will be as follows :—Mr. Goodchild of the Geological Survey will deal with the Geological Survey of the region, Mr. Reclus-Guyou with the Geographical Survey, Mr. Marcel Hardy with the Botanical Survey, Miss Hodgson with Nature Notebooks, and Miss von Wyss with Fresh Water Life, while Professor Geddes will undertake a Historical and Social Survey of the region. In connection with these departments of study numerous special lectures and short courses have been arranged. Thus Sir John Murray will lecture on the Lake Survey of Scotland, Mr. Reclus-Guyou will discuss the alternative routes for the Forth and Clyde Ship Canal, Mr. Henry Coates will lecture on A Regional Museum, and there will be numerous other lectures and discussions on subjects of less purely geographical interest. It is the object of the promoters to consider first of all the requirements of Scottish and English teachers in Nature study, and so far as possible the course of study will be made practical and will be conducted in the open air. Further information can be obtained on application to the Secretary, Mr. D. Maclean, M.A., LL.B., at the Outlook Tower, University Hall, Edinburgh.

COMMERCIAL GEOGRAPHY.

French Guinea.—Captain Cromie, British consul at Dakar, concludes his latest report on the condition of French Guinea, by remarking that the colony, which is barely twelve years' old, has just passed through a crisis so severe that if the methods of administration had been less sound it might have been entirely ruined. There is every reason to believe, he adds, that the crisis is past, and that, in the long-run, it will have been a great benefit to the colony. Rubber, its principal source of income, which in 1899-1900 was practically unsaleable in Europe, has, thanks to the measures taken by the Government, not only recovered its former status, but, owing to the better guarantee of purity, has risen to a price only slightly inferior to that of Para rubber. Other products also have been improved ;

but what will, he thinks, eventually prove of the greatest benefit is that the eyes of the people have been opened to the danger of relying on one product alone ; so that in the future others will be cultivated in increasing quantities, and something will remain in the event of a fall in the price of rubber, although it is inevitable that for many years to come it will continue to be the staple article of export. The sound financial position of the colony is shown by the fact that although 1901 was, from a commercial point of view, little less than disastrous, with the imports less by £240,000 and the exports by £30,000, yet the ordinary receipts brought in more than in 1900, and the Budget showed a surplus of receipts over expenditure of £30,783. The great road to the Niger from the coast is being continued, and will probably be completed during the present year.

Farming in the Canadian North-West.—There have just been issued from the Dominion Census Office at Ottawa two bulletins giving statistics of agricultural operations in Manitoba and the territories of Assiniboia, Saskatchewan, and Alberta. The figures make it possible to realise with something like exactitude the substantial progress, of which most people have a general impression, made by the Canadian North-West between the two census years 1890 and 1900—a progress the rate of which has been much accelerated since the latter date. In Manitoba (with its 41,169,098 acres of land) in 1900 there were 31,812 farms, averaging 278 acres ; 91·30 per cent. of the total acreage being owned by the occupiers and 45·18 per cent. being "improved" land. The area in crops was 2,756,106 acres, showing an increase of 124 per cent. in ten years. No acreage is given for hay, which throughout the North-West is chiefly cut from unbroken prairie. The grain crops show a very large increase in spite of the fact that 1900 was an exceedingly bad year, the average yield of wheat (9·34 bushels per acre) being little more than half the corresponding average of 1890. In the three territories with their 187,932,617 acres of land, the area occupied in 1900 was 6,569,064 acres, against 2,910,144 in 1890 ; and 75·69 per cent. was still "unimproved." The area in crops was 844,020 acres, showing an increase of 649,073, the number of occupiers having risen from 9244 to 23,098. Agricultural values were not included in the census returns of 1890. In 1900 the farm property in Manitoba was valued at nearly £30,000,000 (5 dollars being taken as equivalent to a pound), and the gross value of that year's produce was £4,800,000. In the three territories the farm property was valued at £15,260,000, and the year's produce at £2,560,000. The output of cheese and butter factories rose from £20,000 in Manitoba and £3460 in the territories in 1890 to £80,000 and £20,000 respectively in 1900. It is significant that fruit-trees, of which there were a beggarly thousand in Manitoba in 1890, numbered in 1900 over 62,000, chiefly plum, cherry, and apple, and that there were about 10,000 in the territories. The average rate of wages for hired farm labour, including board, is given as 6·24 dollars (£1, 6s.) per week in Manitoba, 6·83 dollars (£1, 8s. 6d.) in the territories.

British and German Trade with Italy.—A recent report by Mr. Leech of the British Embassy at Rome, on the foreign trade of Italy, shows that in 1901, for the first time, German trade with Italy exceeded that of Great Britain, and Germany now heads the list of foreign countries trading with Italy. Over a sixth of the total Italian export trade is with Germany, in spite of a continuous decline in the quantity of wine sent. On the other hand, this country maintains the foremost place in imports. In 1901 the figures were :—Imports—United Kingdom, £11,174,560 ; Germany, £8,224,960. Exports—United Kingdom, £6,055,720 ; Germany, £9,402,200. Almost half the importation from Great Britain to Italy is composed of coal. Indian imports to Italy, chiefly those of raw

cotton, are increasing, and the total trade between Italy and India in 1901 amounted to nearly $4\frac{1}{4}$ millions sterling, of which the value of the Italian imports was just over three millions. Mr. Leech remarks that a large percentage of the foreign imports of Italy is due to the demand for raw materials for home industries, and the increase in exports is attributable to the greater quantity of manufactured goods, especially cotton and silk tissues, sent abroad. The figures show also that the wine exports are declining largely, and as a portion of the population in almost every district in Italy is engaged in the cultivation of the vine, this is a national calamity. On the other hand, the sugar industry is developing with great rapidity, and it seems destined to introduce a great change in the cultivation of the land in many districts and in the pursuits of the inhabitants.

NEW BOOKS.

EUROPE.

A Handbook of Cyprus. Compiled by Sir J. T. Hutchinson, Chief Justice, and Claude Delaval Cobham, C.M.G., Commissioner of Larnaca. London: Waterlow and Sons, 1903. *Price 2s. 6d.*

The reader who expects much from a handbook compiled by a Chief Justice and a Commissioner will not be disappointed in this little work. In 100, or, to be strictly accurate, in 99 pages, they have compressed everything any reasonable person wants to know about Cyprus. This work is, indeed, a model of condensation, as may be gathered from the fact that the list of contents sets forth ninety different subjects varying from bibliography to prices of provisions, nursing association to wild animals. The handbook is as useful to inquirers at home as to residents in Cyprus, for whom, apparently, it is primarily intended.

ASIA.

In the Andamans and Nicobars. By C. Boden Kloss. London: John Murray, 1903.

In this beautifully illustrated volume we have a bright and well-written account of a cruise in 1901 among the Andaman and Nicobar Islands in the Sea of Bengal, undertaken apparently on behalf of the National Museum at Washington, U.S.A., where the collections obtained during the cruise are now on view. The schooner *Terrapin* was owned and sailed by Dr. Abbot, and had to be specially constructed for the work for which it was intended; it was forty tons register and manned by a crew of Malays, who in such a climate as the Bay of Bengal are much more useful and satisfactory than white men. The *Terrapin* visited all the principal islands of both the Andaman and the Nicobar groups, and altogether the expedition must be pronounced to have been successful. Thanks to the tact and kindness of Mr. Kloss all difficulties in dealing with the natives were easily overcome, and men and women submitted to be measured and photographed with a docility that left nothing to be desired. He was particularly fortunate and successful in his dealings with the wild Shom Pen in the Nicobars, a savage and degraded race, whose origin has been the subject of much speculation. As to their character it may be gathered from a remark made to the author by a Nicobar man, who said, "When one of us sees a Shom Pen he runs away; and when a Shom Pen sees a Nicobar man he spears him!" Under these circumstances it is perhaps

fortunate that the Shom Pen number only between three and four hundred. It was supposed at one time that they were Malayans, but Mr. Kloss gives good reasons for coming to the conclusion that whatever was their origin, they are now a mixed race, having strains not only of Andamanese but also of Dravidian descent. His account of their appearance, dwellings, habits, customs, religious beliefs, etc., is extremely interesting. We may quote a few sentences of his account of the Nicobarese—numerically the most important people in the islands—a wild race where "in the old days it was the custom to kill men for any offence, grave or simple. But at length the elders, finding that the population had greatly diminished thereby, held a council, and introduced the system of killing pigs, burning houses, felling trees, breaking canoes, and destroying clothes, etc., and this method is continued at the present day, side by side with the former. The people seldom have open fighting among themselves, neither do they use their fists, or flog. In extreme cases only (witchcraft) do they commit murder. The Nicobarese have no conception of a Supreme Being or a future state, but there is a universal belief in evil spirits, who are in part ghosts of the wicked, and who can be propitiated by offerings and kept away by exorcisms. These creatures of the imagination . . . are the cause of every misfortune and disease that occurs to man, but death in the ordinary course of things is considered to be a natural event. . . . The natives have no temples or any form of worship, but there have come into being *shamans* or priest-doctors, known as *tamiluanas* and *meluanas*, who have the power of communicating with the spirits, and by means of certain ceremonies, in conjunction with the use of rods, particular leaves, and ashes, periodically, by open warfare and by magic, drive the malignant demons from such places in man's neighbourhood as they may have intruded into, or defeat them when prevailing disease or misfortune can be traced to their agency. These practices and beliefs, which it would be incorrect to class together under the name of religion, are not accompanied by any moral element. Their code of ethics has no connection whatever with the form of malevolent spiritualism which they entertain, but is entirely an affair of public opinion and social convention."

We may add that the author has included in this volume several interesting accounts of the Andamans and Nicobars of long ago, and also an elaborate official description of the famous penal settlement at Port Blair. During the expedition there was but little new exploration in the exact sense of the word, but its results are intensely interesting to the naturalist and ethnologist. As we have already indicated, the illustrations are exceptionally good.

AMERICA.

Jamaica: The New Riviera. A pictorial description of the island and its attractions. By James Johnston, M.D. Printed by Cassell and Company, London, for the Proprietor, Dr. James Johnston, Brown's Town, Jamaica. 1903.

To pleasure-seekers or health-seekers who wish to know something of the attractions of Jamaica, its picturesque scenery, its sunshine and charming climate, we can cordially recommend this book. As a resident in the island for nearly thirty years, Dr. Johnston is familiar with every part of it, and describes its scenes and beauties with all the eloquence of an enthusiastic admirer. Considering its accessibility by the new Imperial Mail Service, direct from Bristol to Kingston in twelve days, it is surprising that it is not more generally frequented as a winter health resort. The numerous large illustrations in the book are alone sufficient to give one a very good idea of the island.

GENERAL.

An English Garner. Voyages and Travels mainly during the Sixteenth and Seventeenth Centuries. 2 vols. With an Introduction by C. Raymond Beazley, Fellow of Merton College, Oxford. Westminster: A. Constable and Co., Ltd., 1903. Pp. 332 and 444. *Price per vol.* 4*s. net.*

This remarkable series of Voyages is a further proof of that restless, adventurous, indomitable spirit which impelled Englishmen during the sixteenth and seventeenth centuries to travel throughout the world and eventually gave them the empire of the sea. The first volume contains the contemporary account of Bodenham's Voyage to Scio in the Levant in 1551, Tomson's Voyage to the West Indies and Mexico, 1556-8, Bodenham's Trip to Mexico, 1564-5, Sir John Hawkins's Voyages to the West Indies, 1562-8, Campion's English Trade to Scio, 1539-70, Munday's Captivity of John Fox, 1577, Stevens's Voyage to India by the Cape Route, 1579, Ganders's Voyage to Tripoli, 1584, Chilton's Travels in Mexico, 1568-85, Cavendish's Voyage Round the Globe, 1586-8, and an Account of the First Englishmen who reached India Overland, 1583-9.

The second volume contains Van Linschoten's Voyage to Goa and back, 1583-92, the Voyage of the *Dog* to the Gulf of Mexico, 1589, the Destruction of Portuguese Carracks by English Seamen, 1592-4, Captain Downton's Fight with the Portuguese, 1594, Hasleton's Adventures, 1582-92, English Trade in the Levant, by Rev. Richard Hakluyt, 1599, Lord Cumberland's Voyage to the Azores, 1589, The *Dolphin's* Fight with the Turks, 1616, The Nombre de Dios Expedition, 1572-3, Knox's Nineteen Years' Captivity in Ceylon, 1660-79, The Capture of St. Helena and Three Dutch East-India Ships, 1673.

In his introduction Mr. Beazley points out that "as distributed throughout the volumes of Arber's *Garner*, these narratives have long been consulted by students of the Tudor and Stuart periods." The greater number are reprinted from Hakluyt's *Principal Navigations* (first edition, 1589, or second edition, 1599-1600), but, besides these Hakluytian pieces, the present volumes contain the interesting and not easily accessible correspondence between Wm. Hawkins and Sir Wm. Cecil, 1568-9, relative to the disaster of San Juan d'Ulloa and that concerning Sir John Hawkins's pretended intrigue with Spain, 1571.

The editor considers that the second volume contains "the gems of the present collection," comprising "narratives of first-class value, not too easy to procure, and as interesting as they are valuable." To Mr. Beazley the geographical world owes a debt for his painstaking care, his conscientious editorship, and geographical zeal. A selection from Voyages such as these, rewritten in modern English, with illustrations, would inspire our modern youth with a desire to emulate their ancestors, and Mr. Beazley might consider his ability to undertake such a patriotic task.

The sufferings and horrors undergone by lion-hearted Englishmen at the hands of Turks, Spaniards, and others are most graphically detailed in these volumes. No modern "tale of derring-do" could beat Munday's account of the captivity of John Fox, an Englishman who delivered 266 Christians out of the captivity of the Turks at Alexandria in 1577. No modern "sensational novel" could thrill us more than does the account of the savage cruelty of the Inquisition practised on Richard Hasleton in Majorca in 1588 by the official "Tormentor" of the Church of Rome.

In perusing these volumes, we are much struck with the intensely religious spirit which pervades them. Shakespeare's dramas give us no conception of the powerful religious movement in progress in England during Elizabethan times. The Reformation leaves its mark strongly on these simple narratives of Elizabethan

mariners who feared neither man nor devil, but would endure untold suffering, or even death itself, rather than acknowledge the creed of Mahomet or the pretensions of Rome.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

L'Amazonie. Par Auguste Plane. Pp. xii + 284. *Prix* 4 *fr.* Paris: Librairie Plon-Nouritt et Cie.

The Place of Industries in Elementary Education. By Katherine E. Dopp. Pp. 208. Cloth. *Net*, $1.00. Chicago: The University of Chicago Press, 1903.

Handbook of Climatology. By Dr. Julius Hann. Translated with the Author's permission from the Second Revised and Enlarged German Edition, with additional references and notes, by Robert de Courcy Ward. Pp. xiii + 437. Royal 8vo. *Price* 12*s.* 6*d.* London: Macmillan and Co., 1903.

An Ivory Trader in North Kenia. The record of an expedition through Kikuya to Galla-land in East Equatorial Africa, with an Account of the Rendili and Burkeneji Tribes. By A. Arkell-Hardwick, F.R.G.S. Illustrated, and a Map. Pp. xvi + 368. Royal 8vo. *Price* 12*s.* 6*d. net.* London: Longmans, Green and Co., 1903.

The Great Siberian Railway from St. Petersburg to Pekin. By Michael Myers Shoemaker. Pp. viii + 243. Demy 8vo. *Price* 9*s. net.* London: Putnam's Sons, 1903.

The Truth about the Civilisation in Congoland. By a Belgian. Pp. 180. Med. 8vo. With a Map. *Price* 1*s. net.* London: Sampson Low, Marston and Co., 1903.

Cities of India. By G. W. Forrest, C.I.E. Pp. xvi + 346. Demy 8vo. Illustrated. 10*s.* 6*d. net.* Westminster: A. Constable and Co., Ltd., 1903.

The Geography of Disease. By Frank Clemow, M.D. Edin., D.P.H. Camb., British Delegate to the Ottoman Board of Health. Pp. xiv + 624. Crown 8vo. 15*s.* (The Cambridge Geographical Series.) Cambridge University Press: C. J. Clay and Sons, 1903.

Also the following Reports, etc. :—

The Restoration of the Ancient Irrigation Works on the Tigris; or, The Re-creation of Chaldea. By Sir William Willcocks, K.C.M.G. Pp. 71. Maps and Illustrations. Cairo: The National Printing Department, 1903.

Reports on the Administration of Rhodesia, 1900-1902. Pp. 473. Maps and Diagram. London: British South Africa Company, 1903.

The Cape of Good Hope Civil Service List, 1903. Edited by Ernest F. Kilpin, C.M.G. Cape Town, 1903.

Bureau of American Ethnology. Nineteenth Annual Report, 1897-1898. Two Parts. Washington: Smithsonian Institution, 1903.

United Free Church of Scotland Foreign Mission Committee's Reference Library Catalogue. 1903.

Annuaire Météorologique pour 1903. Publié par les soins de A. Lancaster. Observatoire Royal de Belgique. Bruxelles, 1903.

El Perú, Estudios Mineralógicos y Geológicos. Primera Serie. Tomo iv. Publicado por la Sociedad Geográfica de Lima. Lima: Libreria e Imprenta Gil. 1902.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE SECOND NORWEGIAN POLAR EXPEDITION IN THE "FRAM," 1898-1902.[1]

By Captain Otto Sverdrup.

Upon learning that Messrs. Axel Heiberg and Ringnes Brothers were willing to defray the costs of a Polar expedition under my guidance and direction, I petitioned the Norwegian Government to lend me the Arctic vessel *Fram*. The Government at once placed her at my service, while the Storthing generously granted 26,000 kroner (= £1445) for the renovation of the ship and the construction of a new saloon forward, two working-cabins, and six berths for the officers and scientific staff. The *Fram* was a first-rate boat before these alterations were made. Prof. Nansen had asked Mr. Collin Archer to make her strong, and strong she unquestionably was. But now she was better than ever; and though she was not so severely tried on the second occasion as she was on the first, still she did not escape without two or three pretty severe tussles.

The original object of the expedition was to spend the winter in the Arctic regions, and by means of sledge-expeditions carry out the scientific exploration of the north-west coast of Greenland. But in case the ice should prove unfavourable for this purpose, or we experienced difficulty in penetrating through Kane basin, the generous authors of the expedition gave me a perfectly free hand to turn my attention to other fields. Thus I was under no obligation to follow a predetermined and unalterable plan.

The *personnel* of the expedition consisted of the following, in addition to myself: Captain Victor Baumann, second in command, who was

[1] A paper read before the Society on May 4, 1903.

appointed first lieutenant in the Norwegian navy in 1895. He had charge of the magnetic observations, having studied magnetism at Berlin and Wilhelmshafen. The "mate" was Mr. Oluf Raanes, who had served as fisherman and seaman on the Coast of Norway all his life. The cartographer was Captain (*Ritmester*) Gunerius Ingvald Isachsen, a cavalry officer in the Norwegian army. The botanist was a Swede, Mr. H. G. Simmons, who had distinguished himself by a botanical expedition to the Færoes. The zoologist was Mr. E. Bay, a Dane, who took part in Lieut. Ryder's expedition to the east coast of Greenland in 1891. Dr. J. Svendsen, a native of Bergen, was the medical man of the party. The geologist was Mr. Per Schei; and the chief engineer Mr. Karl Olsen, with Mr. Jacob Nödtvedt as his principal assistant. The other members of the party consisted of Messrs. P. L. Henriksen, who accompanied Prof. Nansen in the *Fram's* first voyage; I. Fosheim, our hunter; A. H. Lindström, who acted as cook and steward; S. Hassel, R. Stolz, and O. Braskerud—the last two and Fosheim acted as firemen.

We left Christiania on June 24, 1898, for the Danish colonies on the west coast of Greenland, where we took on board sixty-six dogs, which the Royal Greenland Trading Company had kindly bought ready for us. On August 7 we got set fast in the ice of Melville bay, and were kept there until the 13th. After getting out into open water again, we hardly saw any further trace of ice. Watch after watch passed, and we still had the open sea in front of us, and I was beginning to calculate how many days we should need to go through Kennedy channel and Robeson channel. But I was reckoning without my host. The drift-ice was not so very far off after all, for we encountered it in great quantity in the northern end of Smith sound. At first we tried to creep along by the coast of Greenland, but were stopped by the ice, which lay for a long distance to the north, close-packed and motionless, absolutely impenetrable to any ship that ever was built. There was no help for it; we had to turn round and go back the same way we came. As soon as it was practicable, we crossed over to the west side of Smith sound, and made another attempt to penetrate northwards along the coast of Ellesmere Land; but we were again stopped, on August 17, by the drift-ice, close to the little island of Cocked Hat.

It was still early in the year, and we hoped the ice would loosen again, so that we might yet be able to push on farther north before the autumn came to an end. But we were doomed to disappointment. Day after day passed, and the ice never moved, and so effectually blocked our passage. Meanwhile the nights began to be cold, a warning that winter was coming, which suggested to us the advisability of looking about for winter quarters. These we eventually found in a small sheltered cove in the northern part of Rice strait. At that time we were still uncertain whether Hayes sound really was a sound or only a large system of fjords, and as soon as the ice bore, which it did early, for the frost was very severe, we set about exploring the interior parts of Hayes sound.

In the following spring, 1899, we made two expeditions across Elles-

mere Land to its west coast. Bay and I, starting from the inner extremity of North fjord (Nord-fjord), travelled the whole way over bare ground, and came eventually to a large fjord which penetrated due east. Unfortunately the weather was not clear, and we were unable to see far; but what we did see distinctly suggested that we were standing at the head of a very large fjord, and that, further to the west, it sent off still larger side fjords to both north and south. But as we had been unable to transport overland a sufficient supply of food for ourselves and the dogs, it was entirely out of the question for us to think of pushing our investigations further. Meanwhile Isachsen and Braskerud started to cross the glaciated portion of Ellesmere Land. Keeping the whole time to the inland ice, they came at length, near the west coast, to a broad belt of bare ground, which stretched right down to the sea, and prevented them from getting any nearer to it. They also saw a large fjord with some islands in it.

In the year 1899 the ice was again extremely unfavourable in Kane basin, filling it entirely from side to side in a densely packed mass; and in those waters, where the ice is almost wholly without movement, you have to exercise the very greatest care lest you get set fast in it. If you do, you will probably have to stay there the whole year, or perhaps even longer. In the condition in which the ice was that summer, if I had attempted to penetrate it, I should almost certainly have set the *Fram* fast, and that I did not wish to do at any price. For if we did get caught, we should use up during the winter such a large proportion of the dogs' food, that, should an opportunity offer in the following summer for pushing on north, we should be unable to do so. For the journey round the north coast of Greenland, and then down its east coast as far as Sabine island, would necessarily require a large number of dogs, and consequently large supplies of food—larger than we should then have at our command. As it was, we did get ice-bound several times; but only in the outer fringes of the pack, so that there was no real danger, for we very soon drifted south down Smith sound, and so got free again. We made several attempts to penetrate northwards, but all ended the same way; we were carried down Smith sound, and so out into open water.

Accordingly, on August 22, we decided to leave Smith sound and turn southwards into Jones sound. For it was by then in the highest degree doubtful whether the ice would loosen sufficiently to allow of our getting further north, and if we remained in Smith sound, there was a risk of our being frozen in for another winter. On the other hand, we knew that there were several extensive stretches of unexplored land lying north of the point where Inglefield turned back in 1852, and thence up to Greely fjord. Belcher, for instance, saw land due north from Table island, which he called North Cornwall. Besides which, there were many reasons for supposing there existed several islands or patches of land in the big bay between Prince Patrick island and Grant Land. In Jones sound we were overtaken by bad weather, with thick fog, and were at last driven to anchor in a fjord which we called Havne (or Harbour) fjord. This, so far as we were able to judge, was some-

where about the spot where Inglefield turned back in 1852, and whence he believed the coast-line ran back in a northern direction.

Next spring we resolved to establish a depôt as far west as we could get, so that it might serve as a base for future operations. We succeeded in advancing some 60 miles west, but were unable to penetrate further, owing to there being open water as far in that direction as we were able to see. At that point, then, we made our depôt, and christened it Björneborg. On our way back we put into Moskus (Musk) fjord, to see if we could find any game, and were fortunately able to bag twenty-six musk-oxen, which we conveyed in the course of the ensuing autumn the 75 miles which still remained to be traversed to reach the *Fram*.

In the spring of 1900 we sledged west, nine of us, each with his team of dogs. Of these, five men were to travel ten days from Björneborg and then return. It turned out that the coast, instead of trending to the north at Sir Inglis peak, continued west all the way to North Kent. It was terrible work forcing our way along close to the coast until we got through Hell Gate, which is always kept open and free of ice by the powerful current which flows through it. To the north of this sound the coast inclined to the north-east, and we followed it as far as Big Bear cape (Store Björnekap), which we at first took for an island, but which eventually proved to be a peninsula. We called the bay which opened to the west, Norwegian bay (Norskebugten). Owing to the mist we were unable to see very far ahead, but once or twice, when the fog temporarily lifted, we perceived that the coast again turned west, and in the far distance formed the large promontory which we named Cap Sydvest. We thought the coast continued steadily on in the same direction, and suspected Cap Sydvest was on a large island, which was separated from King Oscar Land by a sound. King Oscar Land was the name we gave to the land going northwards from Inglefield's northernmost point.

On March 31 we reached the north side of Norskebugten, almost immediately opposite Eureka sound, which we at the time took to be a large fjord, and which we therefore for a long time called Stor fjord. There we parted from the five men who were to return to Björneborg, and thence escort two others of our party, namely Schei and Henriksen, through Hell Gate to the north side of North Kent, whence they were to make an expedition to the Graham islands, and after that explore the large fjords which lay to the north of Norskebugten. After getting through the sound, the cold had become intense. Indeed, the morning our escort left us, we thought we would console ourselves for the parting with a drop of spirits. But though we pulled and pulled at the brandy-flask, not a drop of the liquor could we get. The spirit was frozen into a solid. However, we picked it out with a piece of sharpened wood, and each man had a spoonful of frozen brandy. The dram was intended to warm us, but I can't say that on this occasion it had precisely that effect. Although for some time the cold was terrific, we suffered no harm, a circumstance I attributed principally to the fact that we were provided with double tents. After we got a little better seasoned, and learnt how to take care of ourselves, we succeeded in almost entirely

avoiding the moisture which adheres to the clothes in those climates, and which has generally occasioned such discomfort to all previous Arctic travellers. Owing to this cause, we were generally pretty comfortable on our sledge journeys. Continuing our route west, towards Cap Sydvest, we had the same difficulty in making headway that we had had ever since we left the sound. It was as much as ever we could do to manage seven or eight miles in a day. Beyond Cap Sydvest the coast turned towards the north-west, and the four of us who were now left pushed on further, notwithstanding the mountainous character of the country, until on the morning of April 15, just as we were setting off for the day's tramp, we discovered fresh land due west.

We agreed to separate, Isachsen and Hassel proceeding to explore the new land we saw to the west, while Fosheim and I continued our sledge tour. The former, after exploring the new land, were to cross over the large bay which lay on the north side of Kap Lev-vel, where we separated; for this bay extended, we saw, a long way to the east, and it was possible it might end in a sound that would bring us through to more easterly waters. But if they failed to discover any such sound, they were to return the same way they went, and visit the large fjords which we perceived opening to the north of Norwegian bay.

Fosheim and I continued, then, towards the north; but, the weather still proving bad, we made even shorter days' journeys than we had counted upon. We were, however, allured on by the continual hope of reaching the northern extremity of the land, and finding there a sound or fjord which would take us east into Greely fjord, or into the waters we had visited in the spring of 1899. But time after time we were disappointed, and on May 7 we were compelled to turn back in about 81° N. lat. and 95° W. long., owing to our food and that of the dogs beginning to run low. The coast still continued to follow the same direction as far as we could see—that is, for some fifteen miles or so further north. On May 7 we set out on our return journey, and on June 3 were once more on board, after an absence of seventy-six days.

On June 19 Isachsen and Hassel returned. They had made a short visit to the new land westwards, and on their way back had ascertained that there was no sound stretching to the east from the large bay that lay north of Cap Lev-vel. From Norskebugten they entered what they took to be a large fjord running towards the north, and followed it up very nearly as far as 79° N. lat., or, in fact, until they judged, as well as the incessant bad weather would let them, that they had reached the head of it. After that, in the same way, they travelled to the extremity of the large fjord which penetrated westwards. Then continuing south along the edge of the land that lay to the east, they passed, but did not enter, a little north of Björnekaplandet, another broad fjord which pointed towards the south-east.

Schei and Henriksen returned from their journey to the Graham islands the day before we reached the ship, having been absent seventy-five days. They too had entered the same large fjord that Isachsen and Hassel had done, but had not gone further north than Björnesund,

in about 78½° N. lat. On their return journey they crossed over Björnekaplandet, and struck Norskebugten a little west of Store Björnekap.

As soon as the ice broke up, we steamed west and went up Cardigan strait, and on August 15 once more got fast in the ice off the north shore of Grinnell island (not Grinnell Land, of course). We found that Arthur strait was only a fjord, and that Grinnell island was thus a peninsula connected with the mainland of North Devon. But, after drifting backwards and forwards for about a month, we came free again, and steered to the head of Gaasefjorden, and there pitched our winter quarters for the third winter—that is, 1900-1.

Our sledge journeys of the spring preceding, especially after the results we obtained from them had been embodied in map form, convinced us more and more that there must be a fjord or sound connecting the northern part of Norskebugten with Greely fjord; and if, as we believed, we now possessed a fairly accurate knowledge of the waterways to the west of Björnekaplandet as far north as lat. 81° N., it was tolerably certain that the sound in question, supposing it really did exist, must start somewhere further east. We concluded, therefore, that it was in all probability a northern branch of the great fjord which went in a south-easterly direction from Björnekaplandet—that is to say, an arm of the fjord which both Isachsen's and Schei's parties had visited the previous season. The probability seemed to be that, after going a little way east, it would turn north, and be somehow connected with the waters which we had discovered when we went overland west from Hayes sound during our first year. And it also seemed probable that the same fjord would prove to be connected with Greely fjord. These problems demanded a solution at all costs, and I determined to tackle them myself. Whilst I was doing this, Isachsen and Hassel agreed to return to the new land we had discovered to the west, and to which we gave the names of Ellef Ringnes Land and Amund Ringnes Land. Even before the autumn closed we attempted a reconnoitring trip to the north, but were unable to surmount the difficulties incident to the constant bad weather, and the repeated breaking up of the ice. As far as we could see from Nordstrand, almost the whole area of Norwegian bay (Norskebugten) was a bright blue sea.

In the spring of 1901 our first proceeding was to travel to Baumann fjord, and establish there a depôt, and thence journey some distance to the north. Both going and returning we entered the fjord which, on the south of Store Björnekap, cut eastwards into the land, and, crossing over an isthmus near its head, came to another broad fjord, which penetrated first eastwards and then due north. At first, we were naturally disposed to think this was the sound we were in search of; but after driving up it for some days, we became convinced not only that it was a *cul-de-sac*, but also that it was impossible there should be a land passage from this fjord in the direction we had anticipated. There was no alternative: we had to turn and go back the same way we came. Heading our dogs towards the north-west in the direction of Storfjorden, we entered a long narrow rift or waterway, which struck off from the east side of this fjord and led towards the north.

But here again we were disappointed. It, too, was apparently a *cul-de-sac*, and terminated at the foot of a precipitous mountain wall, which it would be impossible to climb. We called this Troldfjorden, and well it deserved its name; it was an ugly place, being shut in on both sides by high and gloomy walls of rock, which wore a very threatening aspect. Here again there was manifestly no possibility of advancing further by land. However, as we had already come so far, we decided to pursue the fjord to its extremity. If fortune would only favour us, we might perchance hit upon a little glen or gap of some kind that would take us to the north. On we went, then, and just as we were spinning round a projecting cape, suddenly the mountain wall opened like a doorway, and there, straight before us, was a valley which ran first to the east and then to the north. We had no hesitation in following up the valley, and after some difficulty we succeeded in striking a large fjord on the north side of the land. It was, we felt perfectly certain, one of the waterways we had visited during our first spring, and so we pushed boldly on. We were two sledging-parties travelling together, the intention being to separate as soon as it should appear expedient to do so. This, then, was the moment to do it. Accordingly we parted company on May 4 near the Blaamanden. Whilst Fosheim and the mate travelled northwards towards Greely fjord, along the land that lay to the east, Schei and I stuck to Axel Heiberg Land, intending to push on as far as we could towards the north. We advanced as far as lat. 80½° N. without change of direction; then, however, the coast turned suddenly towards the west, and after we had proceeded some distance farther, we came to ice which, especially as the weather was at the same time so bad, we were unable to get over. Hence we were compelled to turn back long before we expected to have to do so.

When the weather cleared up, we ascertained that there was a broad sea-channel running towards the north-west, and that Axel Heiberg Land extended as far to the north as we were able to see. The northernmost point we reached was Smörgrautberg. Looking hence, we perceived that Greely fjord penetrated Grinnell Land towards the north-east, and was confronted on the west by an imposing mountain chain, which for almost the entire distance that we could see descended perpendicularly into the ocean. There were also several fjords cutting into the land in a northerly direction. On the other hand, Heiberg Land, so far as we were able to command a view of it, was relatively low, scarce rising more than 1500 to 2000 feet above sea-level, and between these altitudes and the sea stretched a wide belt of actual lowlands. Although Heiberg Land held out every promise of an abundance of game, we were, as it happened, still well supplied with provisions; and as, besides, the season was getting on, we thought we could employ our time to better advantage by exploring more thoroughly those parts of the country which lay to the south of us. On our way north we had scarcely given ourselves time to stop anywhere—our one object had been to push on and get as far north as we possibly could. However, we were concerned not merely to determine the boundaries of Heiberg Land, we desired also to explore it. It was penetrated by several large fjords from

various directions, and it would not be without interest to explore these somewhat more closely.

We started on our return journey on May 13. Immediately south of the Blaamanden, the place, it will be remembered, where we separated from our two companions, Fosheim and the mate, but on the other side of the fjord, the flat lowlands were cut into by another large but narrow fjord-like inlet. It appeared to penetrate to a great distance, but how far exactly we were unable to see owing to the low elevation of the land. This was a point we wished to clear up; besides, it would be interesting to examine the wide lowlands which stretched away from the inlet to the south and east. The west side of the inlet was, on the contrary, shut in by high mountains, amongst which I fancied for some time I could perceive glaciers, though it turned out subsequently that I was mistaken. One night, whilst we were still in this neighbourhood, we were suddenly attacked by a pack of about a dozen wolves. Unfortunately, our dogs were muzzled, to prevent them from gnawing their traces, so that they were unable to defend themselves, and came within an ace of being all worried to death.

On our way south, we put in at several branch fjords, believing all the time that the channel we were travelling down lay to the east of the Storfjorden. Our surprise may, therefore, be imagined when we discovered, as we did eventually, that it was Storfjorden itself we were in. The identification was, however, undoubted, for Schei recognised again the spot where he had encamped the year before, close to Björnesund. If only we had been aware of this when we started, we should have been enabled to obtain a very different idea of the lands which lie west and north of Greely fjord. The longest of these branch fjords, which we called Skaarefjorden, extended some 28 miles in a north-west direction. Whilst we were encamped at the head of this fjord, we were assailed in the middle of the night by a terrific storm, which drove us to seek shelter in a sort of cañon we had discovered on our way up the fjord. The wind was so violent, it literally blew the sledges along the ice, and at such a pace that we had difficulty in preventing them from being overturned, while the snow fell so thick and fast that we were scarce able to see an inch before our noses. However, we luckily made the cañon without mishap. Crossing the sandbank at its entrance, we proceeded a little way up the glen, and could readily have believed we were come into—paradise: it was perfectly still, not a breath of wind.

After that we crossed the Hyperite peninsula, and from thence reached the northern parts of Björnekaplandet, and then travelled south along this last. At two places in this district we found big accumulations of fossils, and from Björnekap we each took a big sledge load of rock specimens home with us. It was June 18 when we got back to the *Fram*.

Isachsen and Hassel had reached the ship on June 7. The chief results of their expedition to the lands to the west were these: They ascertained that they extended as far west as about 106° W. long., and as far north as approximately lat. 79°. They were almost entirely of low elevation, barely being more than 500 feet above the level of the

sea. The coasts which fell away towards open water were so low, it was sometimes not at all easy to distinguish where the land ended and the ocean began. Fosheim and Raanes, who had parted from me near Bay's fjord, returned to the *Fram* on June 13, having mapped Canyon fjord and the lower parts of Bay's fjord.

In the meantime Baumann and Stolz had mapped Baumann fjord.

This summer we fully intended to return home, but in this we were deceived, for the ice never broke up in Gaasefjorden. We tried, of course, to force our way out by ramming, but the ice was too thick. Then we attempted to blast it with explosives, but with no better result. And even if we had succeeded in breaking the ice, we should have been in no better position, for there was no room to push it on one side out of the way. After a month's hard work we gave up the attempt on September 6, having cut through about 9 miles in all, and there were still 5 or 6 miles before we could reach the open sea. This was a severe blow to us all. We had fully counted upon reaching home that autumn, and the only thing which prevented us was that paltry 5 miles of ice, for that year Jones sound was freer from ice than we had ever seen it before. However, it was no use lamenting, so we set to work at once to lay in a stock of meat to keep the dogs alive during the winter. Since we were to stay another year amongst the Arctic ice, we had better turn the time to some good purpose. We could do nothing without the dogs. So we dragged a boat across the belt of ice, and got her ready for hunting walrus. We had another whale-boat lying at our fourth camp on the north side of the land. Four of us therefore crossed overland from the head of the fjord, and sailed the second boat south through Hell Gate into Jones sound. Then we established a fishing-station at Maasefjeld, as we called the steep cape at the west side of Goose fjord. As soon as we had finished our preparations, we discovered that the first boat's crew had done precisely the same thing, but that at the moment they were absent, having gone up the fjord with a boat-load of walrus flesh. All the time we were engaged in catching walrus, there was, fortunately for us, a stiff breeze blowing from the north, which kept the fjord open. But, the frost setting in towards the end of September, we soon had to give up fishing; however, we had done very well, and had quite enough meat to last us through the winter. With the view of shortening the distance we should have to sledge the meat, we took it round to the outer isthmus, and there left it until the ice was strong enough for sledging.

In the following spring, Baumann and two other men went to Beechey island to find out if there was anything left of the large depôt which the English made there half a century ago. On his return he reported that the depôt was entirely destroyed, except for a few fragments of the house which the English built. The sloop *Mary*, which had been left there drawn up on land, was also entirely destroyed; amongst other things, her mast had been sawn off. Isachsen and Bay explored and mapped the unknown parts of North Devon, and reached the *Fram* again on May 22. Meanwhile Schei and I proceeded up Eureka sound, and mapped those districts west of Greely fjord which had not already

been mapped, and were back again by June 16. In this expedition we were fortunately able to determine the northern boundaries of Axel Heiberg Land, as well as the previously unknown coasts that lay west of Greely fjord. The northern parts were appreciably lower than the districts in the south, and consisted of low rounded hills and ridges (*aus*) of gravel, with immense sandbanks stretching beyond a long way out to sea. These numerous eminences, with the broad shallow valleys between, gave the region the appearance of having been originally an archipelago, which had subsequently been raised above sea-level.

The northern part of Axel Heiberg Land was not particularly high, presumably, as I have already said, not much above 1500 feet. Nevertheless, its coast fell for considerable distances vertically into the sea. Its northernmost point lay in 81° 20′ N. lat. and its westernmost in about 95° long.

From the farthest point north to which we advanced, namely Land's-Lok, in about 81° 40′ N. lat. and long. 94° W., we were unable to see land in any quarter, either towards the north or towards the west. The new islands which we discovered would therefore appear to form the natural termination of the Polar archipelago that lies north of the American continent. Although I am not prepared to assert there really does exist no land to the north or west of the point I have indicated, I have no hesitation in saying I think it extremely unlikely that land will be discovered in those directions, for, as far as ever we were able to see, there was nothing but sea, covered with ice of the usual coarse Arctic character. It is true, the ice was forced up against the land in pressure ridges to an almost inconceivable height; still, that is not enough to justify the conclusion that there exists no land farther west, for the drift-ice can be forced up in this way without having an extraordinary amount of sea-room behind it. In fact, I have nowhere seen such gigantic pressure-ridges as those we encountered along the stretch of coast between Cap Sydvest and Cap Lev-vel, and those ridges were caused by pressure coming from the west and south-west.

During the whole course of the expedition we never saw anything that might be described as palæocrystic ice. The entire distance from Land's-Lok to Smörgrautberget was packed with old Arctic ice which had been subjected to great pressure. Its appearance suggested that, at any rate in the summer of 1901, the entire region had been covered with ice, for the great ridges were all rounded off as they would be if the ice had melted on the surface. The first year, too, that we visited that part of the coast the old ice covered every inch of the distance between the Blaamanden and the Smörgrautberget, and even extended beyond the latter for as far as we could see. During the autumn of 1900 the ice had been subjected to an immense pressure; in fact, from the sledge-traveller's point of view I never did see worse ice anywhere. It was quite clear, however, that open channels do exist in these waters. We had unmistakable proofs of them during our trip from Land's-Lok to the northern part of Axel Heiberg Land, for there one had run diagonally right across the fjord, and we travelled the whole way down it, until we reached the land, on new ice only one winter old, and

actually followed it some distance further south, for it continued to run parallel with the coast. I feel pretty certain that in most years there is here a belt of open water running from north to south, for although the ice was extremely unfavourable in the previous summer, there had nevertheless been an open channel, for in many places we found ridges of new ice pressed up between the old. There was old ice also along the west coast of Heiberg Land; but mile after mile there had, during the preceding autumn, extended a narrow channel or lane of open water, for we observed there a good deal of new ice amongst the ice ridges. We also encountered very old Arctic ice off the north side of Isachsen's Land and Ellef Ringnes's Land, where it was driven close in to the coast, and even upon it, in a series of parallel ridges of formidable dimensions.

Throughout the whole of the long distance from Blaafjeldet to Land's-Lok we did not observe the remotest sign of a glacier, nor was there any indication of glacial formation on the other side of the sound until we reached Skaare fjord, and discovered a glacier-tongue a little way up the glen. We subsequently found another glacier-tongue in Ulvefjorden, and others in a few places between Hyperite peninsula and Cap Sydvest. I scarcely think that any real glaciers were found on Axel Heiberg Land, any more than on the newly discovered islands to the west. On the other hand, a considerable part of King Oscar Land is covered with glacial ice. But in no place along the actual coast did we find glacier-tongues reaching down to the sea; there was everywhere a broad belt of lowland between the glacial ice and the water, but Fosheim and the mate noted one large glacier reaching down to the water in Cañon fjord. On the south of the land the case was however quite different, for there the inland ice capped large stretches of country, while numerous glacial arms descended into the valleys, though seldom far enough to reach into the actual fjords.

Appearances seemed to indicate that the precipitation was very small, and I believe it is considerably less in the channels near Eureka sound and to the north of it than, for example, on the west side of Axel Heiberg Land, where it would sometimes seem to be not inconsiderable. Yet even there it is nothing like sufficient to furnish material for inland ice.

In many parts of the newly discovered lands there would appear to exist an abundance of animal life, especially musk-oxen and smaller game, such as hares and ptarmigan, as well as foxes and wolves. The larger animals kept principally to the inner parts of the fjords, because it is there they find most readily such means of sustenance as they require; but there are also several parts of the coast which they frequent in large numbers. This is especially true of Björnekaplandet and Schei island. Reindeer exist away to the west, but in scanty numbers. The only other district where we met with them was in Björnekaplandet, and, as a rule, their numbers decreased as we advanced north. On the west side of Axel Heiberg Land we again saw numerous traces of reindeer, but no indication of musk-oxen. All the same, I do not doubt that musk-oxen would be found by proceeding a little way up the fjords,

for we had abundant evidence that animals of all kinds were plentiful enough throughout the whole of the east coast of that land. I got the impression that the reindeer are only summer visitors in those parts, and that they come there in the spring from lands farther to the west, and return again in the autumn as soon as the ice is strong enough to bear them. But this is only a surmise; I have no positive information bearing upon the point. Bears also were pretty numerous in certain localities, both in Jones sound and all the way along the coast of King Oscar Land northwards from Eureka sound. But on the west side of Axel Heiberg Land we did not observe the slightest trace of these animals north of Cap Sydvest.

Almost everywhere we discovered the remains of Eskimo habitations, winter houses built of stone and whalebone, as well as traces of tents, meat-cellars, and fox-traps. These occurred upon almost every headland along the south and west coasts, and we also came across indications of human beings having visited the inner parts of the fjords. In the course of our expedition overland from Norfjorden to Bay's fjord we several times observed the circular markings where tents had stood, proving that the Eskimo were well acquainted with that region, and had made good use of this short cut overland. On the east side of Axel Heiberg Land again we observed several indications of Eskimo having visited the region; indeed, there were even tent markings along the coast between Greely fjord and Land's-Lok. On the other hand, we found no signs of even temporary occupation on the west side of Axel Heiberg Land. Curiously enough, at Björneborg there were, besides the usual Eskimo remains, two round towers built of stone. Presumably they were constructed by the Eskimo, although I confess I have never seen structures similar to these that they have built anywhere else.

With regard to the route which the Eskimo followed in their migrations into Greenland, it would, of course, be rash to say anything positive. Yet it is not improbable that the main stream followed a north-east direction across the North American archipelago, *viâ* the northern parts of North Devon, and thence north along the coast of King Oscar Land, through Eureka sound, into Greely fjord, then overland to Archer fjord, and so on northwards to the north-west coast of Greenland. Of course, this does not exclude the possibility that a smaller stream may have preferred to keep to the coast, and so gone right round Grant Land, and in that way reached the north-west coast of Greenland, whence they would continue round its north coast, and so push on down its east coast. I should also be strongly inclined to suspect that a portion of them may have crossed overland from Bay's fjord to Hayes sound, and thence proceeded across Smith sound to the west coast of Greenland, and so on further south. It must be left to the future to decide how far these points are capable of being cleared up by a scientific examination of the various objects of wood and bone which we discovered, besides the different remains and encampments, as also the solution of the age of the remains themselves.

The scientific results of the expedition have, I venture to say, been of considerable value. Meteorological observations were taken every

second hour, both in summer and in winter; records were also made of the temperature of the sea and of the ice, as well as of the tidal water. Magnetic observations were made at each of our several winter quarters. Collections of the greatest possible extent were made by the scientific staff, and they brought home with them rich and valuable materials for the study of the zoology, botany, and geology of those new lands, parts of the Arctic which had never before been visited.

Stubborn and intractable though the ice was in Goose fjord in 1901, in the following year it proved just as ready to serve us. By July 30, 1902, we got out to the entrance of the fjord; but had to return, because the prevailing east wind had packed the ice together in such vast masses outside the fjord, that it was impossible for us to get through. Besides, a boat party who had gone off for the purpose of scraping the bottom of their boat, were not yet back on board. But on August 6 we said good-bye finally to Goose fjord, and on the 17th entered Godhavn without having met with the slightest hindrance from the ice, either in Jones sound or in Melville bay. We left Godhavn on August 21, and reached Norway on September 19, 1902, after an absence of four and a quarter years.

Summary of Geological Results, by Mr. Schei.

The second expedition of the *Fram* had the good fortune, under the stress of circumstances, to be forced to spend four years in the regions lying between the parts explored by the two great expeditions of Franklin and Nares.

Thanks to the more stationary nature of its operations, as well as to the advantage of being able to employ more modern appliances and methods, and above all to the use made of dogs in sleighing expeditions, the second *Fram* expedition has been enabled to collect on the whole a pretty large quantity of scientific material. Indeed, of such an extensive character is it, that as yet a good deal of it has not been examined scientifically, some even has not been distributed for examination. All that can be said here, therefore, is that meteorological observations, embracing observations on the direction of the wind and its velocity, the temperature of the air, its pressure and its degree of humidity, as well as the amount of cloud, were taken every second hour from September 1898 to August 1899; from September 1899 to August 1900; and from September 1900 to July 1902, in the several winter quarters we wintered at.

Observations were taken of the tides at various periods, with the object of determining the magnetic force, and pendulum observations were also made.

The zoological collections, which were made by Mr. Bay, embrace a large number of preparations and specimens, amongst them 2000 preparations preserved in spirits. Of these, the collections of the lower forms of life, especially echinoderms and plankton, may be particularly singled out for mention, both on account of their great variety and the special interest they inherently possess.

The collections of plant life made by Mr. Simmons embrace no less than 50,000 examples. The collector has reserved to himself the study of the phanerogams and algæ, leaving the remainder to be taken in hand by various specialists. This great wealth of material may be expected to yield, besides a host of individual facts, an almost complete survey of the botanical geography of that particularly important part of the world.

As regards the geological results, here alone I am able to offer detailed information. My collections embrace specimens of Archæan rocks from Foulke fjord and the south side of Hayes sound, as well as of the Cambrian and Silurian formations, which are developed to a great thickness in Bache peninsula and on the north side of Princess Marie bay. A pretty complete collection was made of the Silurian and Devonian formations which occur in the western part of Jones sound; and they have furnished materials for determining in considerable detail the order of the series in these two formations. Most of the localities examined in Goose fjord and Hell Gate were prolific in fossils. Here we have a series the several members of which yielded 16, 11, and 22 species respectively on a first provisional examination, belonging apparently to the Wenlock and Ludlow divisions of the Upper Silurian; while the members of the Devonian series have supplied 55, 20, 13, 16, and so forth, species, again on a preliminary survey. This takes no account of the remains of fishes, which have not yet been identified, though Dr. Traquair of Edinburgh has kindly undertaken to examine them; nor does it embrace, either, the specimens, abundant in numbers, but poor in species, of Upper Devonian plants which were gathered in three localities in Goose fjord, and which Professor Nathorst in Stockholm has undertaken to report upon.

We also brought home an important collection of Upper Carboniferous fossils from Big Bear cape (Store Björnekap), which have gone into the hands of Professor Tshernytcheff of St. Petersburg. Here are at least forty species, some of them represented by several specimens, and all of especial interest, owing to their resemblance to fossils from the Upper Carboniferous rocks found in the north of Europe.

Great interest attaches also to the collection of specimens belonging to the Mesozoic deposits of Eureka sound. Thanks to Sir Leopold M'Clintock, Admiral Sherard Osborn, and Sir Edward Belcher, we already knew of the existence of a few Mesozoic fossils in the Parry islands. My Mesozoic collection contains, therefore, nothing new; and as the collections are small and incomplete, they do not afford anything like materials for a complete summary. They do, however, prove this—that the Mesozoic deposits of King Oscar Land, Heiberg Land, and Grinnell Land are very widely distributed, as well as possessed of greater intrinsic importance than the similar deposits in other parts of the North American archipelago, since they point, as do also the Carboniferous fossils, to North European affinities rather than to American. At Cape Blue Mountain (Blaafjeld) I picked up a black shale containing a *Daonella*, and both rock and fossil are precisely similar to a rock and fossil from Spitzbergen, where Alpine Triassic is known to exist.

Professor Nathorst says that the Tertiary plant remains which Mr. Simmons has brought home from Coal fjord (Kulfjord), in Baumann fjord, are in their several ways unparalleled. Out of two or three large pieces of greyish-black clay he has succeeded in washing out portions of stems with their adherent leaves, and has mounted them upon cardboard just as though they were parts of a dried plant which was plucked only the other day. Thus he will be able to examine microscopically the structure of both the leaves and stems of plants which grew, it may be, a million of years ago in a part of the world where at the present day there does not exist a single tree, and which have for their nearest known congeners the giant tree of California, *Sequoia*, and the swamp cypress, *Taxodium*, of Florida.

In the light of these various fossil collections, we are now in a position to interpret the history of this portion of the Earth's surface during pretty long periods.

In North Lincoln Land, and both northwards to Hayes sound and westwards as far as Harbour fjord, there exists an Archæan formation built up out of granites of a peculiar character by ancient volcanic outbreaks, and over this there flowed in Cambrian times a sea, which has in part worn away the outlying Archæan rocks. We have thick quartz sandstones in Bache peninsula and in Foulke fjord, and we have reports of still greater developments in Inglefield gulf, North Somerset, etc.

In part the Cambrian sea would appear to have washed the base of limestone mountain walls, which were formed and deposited long before in water; for interpolated between and lying upon the sandstone in Bache peninsula and Jones sound there exist conglomerates of limestone and of calcareous sandstone hundreds of feet thick. After that the sea overflowed these localities, and deposited, in the Middle Silurian epoch, thick strata of limestone, at least 2000 feet deep, in, *e.g.*, Princess Marie bay and Jones sound.

During the early portion of the Devonian epoch, the formations of the deeper seas were laid down in the form of black shales and limestones; but by the close of that epoch the coasts had approached nearer together, and in the quieter, deeper reaches of the estuaries fish remains settled down, along with fragments of the plants which grew on the adjacent shores, and both were buried in the argillaceous mud which collected amongst the sand and gravel along the shore.

The richly fossiliferous limestone, with embedded flints, which exists at Big Bear cape, tells us that at the close of the Carboniferous era the sea was again predominant, although of the conditions which existed immediately before and immediately after that epoch we know nothing. Ammonite mountain, in the northern part of Bear Cape Land, records that in Triassic times the sea reached quite close up to that spot, for its sandstones and arenaceous limestones contain lamellibranchs and an ammonite of that age. But about the close of the Triassic epoch, or a little later, this part of the Earth's surface underwent tremendous changes.

The Blackwall (Sorte Vaeg), in the north of Heiberg Land, shows that volcanic craters were already in existence there in Carboniferous

times, and spouted out lava, which spread itself in broad streams over the layers of limestone and flint. The existence of tuff strata intercalated between the lava-beds shows, further, that the volcanic outbreaks were accompanied by showers of ashes. However, the Carboniferous sea once more asserted its supremacy, and laid down fresh strata of flint and limestone on the top of the tuffs and lavas. But the volcanic disturbances did not reach their culmination until after the Triassic deposits were all laid down. The Earth's crust was split by gigantic fissures, and the several areas thus formed were dislocated both horizontally and vertically, but more particularly the latter. At the same time volcanic matter burst up through these fissures and forced its way in between the sedimentary fossiliferous rocks. In virtue of their greater power of resisting disintegration, these intrusive outflows now appear in the form of black strips and vertical walls, interpenetrating the more yielding contours of the sandstone and limestone strata. This volcanic activity, as well as the most violent dislocations, seem to have been confined to the immediate vicinity of Eureka sound.

Ellesmere Land and King Oscar Land have the contours of a table-land. The younger formations of North Lincoln Land are separated from the Archæan rocks. The level surface of the latter lies at the same elevation as the subsided sedimentary strata on the west and the north. But at Eureka sound the plateaus have steep vertical sides, and have been disturbed by the eruptive outbreaks, imparting a more rugged aspect to the landscape, with sharper edges and isolated peaks.

The Miocene sea deposited its clay and sands in the valleys and depressions of the dry land, which owed their existence to dislocation and erosion. It is in these deposits that we have found the splendidly preserved remains of former vegetation to which I have already alluded, those allied to the giant *Sequoia* of California and the swamp cypress of Florida.

The youngest evidences of marine action are the sands and clays, with sub-fossil remains of existing marine organisms, which were observed at an altitude of 650 feet all round the coasts of Ellesmere Land. The altitude to which that sea rose is indicated for the most part by the loose materials of the marine terraces, although traces of it are not wanting in the hard rock, namely, in the form of a flat shore formation, in, *e.g.*, Baumann fjord and to the north of the Seventeenth of May hill (Syttende Mai Haugen). The same phenomenon is exhibited in the foreland, which, to the breadth of one to three miles and to the height of 650 feet, encircles the plateau, especially in many localities in Eureka sound. It is also very clearly seen on Graham island.

One of the principal features of these regions is, of course, their glaciation. North Lincoln Land is, as we know, glaciated. The interior is covered by a more or less continuous sheet of ice, and from it big glaciers push themselves down into the sea from Fram harbour in Jones sound right round to the inside of Hayes sound, although in the latter locality there are considerable areas entirely free from ice. The same thing is true in even a more extended sense in the districts bordering in Jones sound. The glaciation becomes less pronounced as one

advances west. First the glaciers retreat from the actual coast, and finally disappear altogether. The higher parts of the interior of King Oscar Land are, it is true, covered with ice, but it is so thin as to be unable to give off any glaciers. In the usual acceptation of the term this land is not "glaciated," and the same thing is true of the west of Grinnell Land and of the greater part of Heiberg Land. The only exception in the case of the last-named is the south-east corner, where, however, scarce a single glacier reaches the sea. So far as I am able to judge, this reappearance of glaciation in the regions farthest west is due to the relatively greater precipitation, but principally to the configuration of the country. I fancy the wind drifts the snow together and deposits it on the short, steep slopes which are here found to exist, but nowhere else. You never find a thick ice cap on the level heights or on the top of the plateau.

From what is stated above, it will be inferred—what is, indeed, true—that in the summer extensive tracts of country are entirely free of both snow and ice.

After examining the unglaciated parts of the region with the view to discovering whether they may possibly have been subjected to glaciation at some earlier period, I arrived at results of a negative character. I nowhere observed *roches moutonnées*, neither did I observe striæ or scorings. Nay, further, I did not perceive any loose materials that could with any degree of likelihood be ascribed to the effects of glacier ice. Moreover, in several places I noticed marine terraces at a great height above the sea, running immediately in front of the existing glaciers, and in such a position that it is scarcely conceivable they could have been formed with the sea at its corresponding elevation if there had existed glaciation of even the same intensity as that which now obtains, to say nothing of a greater intensity. I believe I may venture to say, that in those regions the existing glaciation represents a maximum, such as has never been attained before, and if this conclusion should turn out to be sound, it is one, I need hardly say, of considerable importance from the point of view of physical as well as of biological geography.

CLIMATIC FACTORS IN RAILROAD CONSTRUCTION AND OPERATION.[1]

By Robert Marshall Brown,
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The use of railroad publications as material for geographical study has long been advocated. In the past, localities which became pre-eminent in industry and strength were located along some waterway, the chief path of travel and transportation. The advent of the railroad allowed the

[1] An article which appeared in the *Journal of Geography*, April 1903.

growth of centres of life apart from river banks and ocean fronts. In many countries, as in the United States, the prominent lines of trade do not agree in direction with the paths of navigable streams. Thus railroads assume a geographical importance, and are factors in commercial supremacy and also in the distribution of people. Furthermore, engineering problems in the construction of roads and maintenance of way may be used as a measure of the physical conditions of any country. The Cantilever Bridge cannot be separated from the gorge of the Niagara. The St. Gothard tunnel must convey some notion of the topography from Milan to Lucerne. The winding character of the same road, and the spiral tunnels on both sides of the great tunnel, must further emphasise the irregularity of the land. So it is believed that the struggle of railroads against climatic conditions must aid in an understanding of the climate of the country traversed.

The railroad districts of the world have, for the purpose of the present discussion, been somewhat arbitrarily classified under the headings of Regions of Heavy Precipitation, Regions of Moderate Precipitation, Regions of High Altitudes, and Regions of Severe Winters.

Regions of Heavy Precipitation.

Regions of heavy rain are often regions of seasonal rain. When the rainy season has passed, a season of drought begins.

Moisture has a destructive effect upon the ties, the woodwork of bridges, etc., and may be instrumental in the oxidisation of rails, while the dryness causes splintering and withering. Ties decay when there is a good supply of moisture. The ties should not be wholly immersed as there must be a free access of oxygen. Moreover, the temperature must be between 32° and 150°, for there is no decay below 32° and no fermentation above 150°. The expense of creosoting has been necessary in many of the rainy districts, and where the essential oils thoroughly penetrated the ties, the preservation of the wood seems to have been complete. In 1863, the Madras Railroad in India reported that unfavourable climatic conditions consumed the best sleepers in six years, and that 40 per cent. of them had to be renewed annually. It was furthermore maintained that if sleepers could be procured to withstand the climate, the road might be opened from Delhi to Calcutta, instead of to Agra. The estimated cost of the renewing of ties at this point was £130,000. A little later, in 1870, in the province of São Paulo, Brazil, the engineers of the São Paulo Railroad reported that the sleepers on the Serra had to be removed in some instances a few months after they had been laid, and that the iron sleeper chain road would be less expensive in the end in the inter-tropical countries.

The Cape Government Railroad in South Africa experienced a similar loss in rail foundations. After repeated tests of the durability of various kinds of timber as sleepers, the management of the road deemed it prudent to further plans towards maintaining plantations of the camphor-tree, the timber of which has been proved the best for ties. Several bridges of Oregon pine between Escuintla and Palin, in Central

America, were considered unsafe shortly after construction. It is said that no wood will last in that climate; ties must be renewed every eight months and telegraph poles rot off in six months. The effect of the sun may be shown in the single example from the Sind Railroad in India, where, on account of the extreme dryness, many of the pine sleepers so twisted and split that they had to be renewed after a single season. These same sleepers had been prepared against decay and successfully withstood the rainy season.

Many examples might be given of the difficulties which have been encountered in railroading on account of disease. In 1896 the construction of the Sudan Railroad, just on the border of the rainy zone and south of the desert, was undertaken and little difficulty was met with until June, when cholera broke out among the labourers, and the loss of life became enormous. An extension of the Sudan road to the south, as the British Central African road, was debateable on these grounds, for in the swamp regions of the White Nile and Bahr-el-Ghazal the fevers are far worse than in Dar Fur or Wadai in the Sudan. There are, perhaps, individual white men who could live for years in this belt, but it is generally conceded that the white race cannot live long in such a climate. The Egyptian battalion of Dar Fur lost through sickness one-third of its men in one year in this locality. The Tehuantepec Railroad in Central America was nearly completed when operations had to be suspended because fever had decimated the men. India shows, as do other localities, that the health of the employee must receive the careful attention of the constructor. In Sind, the central province of British India, it was incumbent on the builders to erect huts to protect the men from the heavy dew. In addition, permanent hospitals were erected at Karáchi (Kurrachee) and Kotri, and temporary hospitals were found necessary at Joong Shaie and Dovaji Gore. More forcible still is the statement from Goa, the small Portuguese province on the west coast of India, that in the construction of the India-Portuguese Railroad the medical staff treated 63,000 patients in the hospitals in the four years of work, apart from the number attended in their own huts. In 1884 even the medical staff was insufficient, for on the outbreak of sporadic cholera, the people fled, leaving many dead by the way. On the Ghâts, the greatest sickness occurred in the months of April and May, whereas on the coast it was experienced after the rainy monsoon, in October and November. During the first two years of construction on the Ghâts, the percentage of cases of sickness to the total number of operatives was 90, while during the last two years it was reduced to 20. So also at Mormugao harbour the percentages were 54 and 17 respectively. The decrease in sickness was due in part to sanitary measures, while the extensive clearing of jungles for lime and brick burning, and for fuel, tended to make the locality more healthful.

To supply men with wholesome water is imperative. When this precaution is not observed, the operative is under the necessity of using such water as is obtainable, and where impure water is used, disease is very likely to follow. Early in the history of the Sind road, a regular system of carts and bullocks was organised for carrying water, and later

these were replaced by water trains. Considerable trouble was experienced on first opening the line because of the scarcity of pure water for use in locomotives, and because of the absolute lack of water during the dry season. A solution of this difficulty was tried in India by the building of huge tanks in the ground, with a catchment area such that, with even a very small rainfall, these tanks would collect enough water to furnish a supply for the dry season.

The excessive heat of the dry season, and the heavy rainfall of the wet season, combine in decreasing the number of working days, and consequently in increasing the expense of construction. Coolies accustomed to the climate of the hot and comparatively arid plains may be employed as labourers, as on the Ceylon Government Railroad. The time necessary for construction was here increased by the number of wet days, on which it was impossible to get these coolies to perform a good day's work, so sensitive are they to slight changes of temperature. In Sierra Leone, a British province on the western coast of Africa, with a heavy rainfall (138 inches per year at Freetown), it is easily seen how great would be the retardation of the work. The coming of the rain may stop the work, but when the rain does not come no benefit accrues to the road, for the suffering is often magnified. Such was the experience in 1891 in India, when horses fell dead when at work, and cases of sunstroke and heat apoplexy, many of them fatal, were daily occurrences, work being impossible between 9 A.M. and 4 P.M.

Chronicles of floods and estimates of damages by overflow make a well-known chapter in the history of any railroad. Very heavy rainfalls in the Sudan, in Central America, in California, are registered on the books of companies with unceasing regularity. From Hankow and Canton comes the report of the rising of the Canton (Chu-kiang) and Yangtse-kiang to a height of 40 and 50 feet; from Peking, the blockade of traffic to Paoting-fu with the arrival of the rains; from Tientsin-fu and Shanhai-kuan, the destruction of the road bed during the wet season of four months; from Shantung, the struggle with the Hoang-ho, "China's Sorrow"; from the Nawalapitiya and Nanu in Ceylon, the results of exposure to a north-east as well as a south-west monsoon; from the Sind, the impossibility of providing culverts large enough to relieve the floods; from the Indian road the flooding of the track by the rising of the Nerbudda; from the Bolan Road of India, the abandonment of the road because of floods; from the Sudan Railroad the destruction of 60 per cent. of the way; from the Southern Pacific, in California, the details of large expenditures. The history of every road that traverses the belt of heavy precipitation is a story of continual struggle against flood. It is well to note in passing that the Sind authorities in 1861 were willing to foster the belief that in regions like Sind, where rainfall is so uncertain, of such short duration, and at the same time so heavy, the safest and most economical way of crossing a large flat plain is to lower the track to the surface and allow the water to flow over the well-ballasted bed at will. The "annoyance" of a subaqueous road bed was endured five years.

In regions of heavy rainfall, landslips are so frequent that they are

in the category of commonplace experiences in railroad management, and although they may be exceedingly disastrous, the greater number of them occur without fatality. Ceylon records a rainfall which, at the end of 11 days, with 28·56 inches of rain, caused so many slips near Nanu that the traffic was interrupted for six weeks; and other years are apt to repeat the experience. The Darjiling Himalayan Road was forced to suspend traffic for a longer period when, in 1890, 86 inches of rain fell between July 1st and July 26th. The side of a large hill was precipitated upon the track. The reports of the La Guaira and Caracas Railroad in Venezuela mention frequent landslips during the rainy season of six months. As many as two hundred have been known to occur in one night. Trains have been imprisoned for days between huge landslips. On one occasion the slips were so numerous that on the whole track there were not four hundred consecutive yards of clear line. A typical case can be cited from the Sacramento River Canyon, where the rainfall for five months ending March 1, 1890, was 100 inches (annual average 59 inches). In consequence of the heavy precipitation the ground became saturated, and large masses of earth and slaty rock, estimated at 25,000 cubic feet, fell on the track. The line was cleared, with an expenditure amounting to 5500 days' work, just in time to receive a second landslip as large as the first. The danger had so increased that night work was not practical, and the day workers were so much endangered that even when all possible precautions for safety were taken, very little effective work was done. The gravity head of water, as in mining operations, was used to remove the debris, and in nine days 9000 cubic yards of material were removed, at an average cost of $200 per day.

In India, during the four months from June 15 to October 15, the rain is heavy, and a fall of from 5 to 9 inches in 24 hours is not sufficiently unusual to cause comment. At the end of the rains, for a short season the sun control is very strong. Those who made permanent way a study soon found that the brick ballast in use in India not only damaged the sleepers, but also acted disastrously on the rails and fish plates, while during the rainy seasons it was almost impossible to preserve a good line and surface, or to keep the road free from vegetation. During April and May the hot winds blow with great force over parts of India, and prohibit the use of ashes or sand unless covered, as on the Sind, Punjab, and Delhi Road, with a coating of ballast 3 or 4 inches thick. Ashes were tried on some large viaducts in order to lessen the cost and so preserve the brick arches, but during the hot weather trains were so smothered in dust that workmen were unable to tell when they were approaching. Furthermore, the inconvenience to passengers was so great that the idea had to be abandoned, and stone ballast substituted. In the northern provinces of India, "kunkin," a peculiar formation of limestone, was tried for ballast. The rainy season soon reduced it to slush, and during the dry windy weather dust flew up as the trains passed by, and damaged the machinery of engines and bearings of carriages, causing 15 per cent. more hot axles than on the lines ballasted with stone. American roadmasters and English inspectors have recorded

the opinion that while under most conditions stone ballast is the more expensive, the Indian climate reverses the order for the roads which traverse its domains.

Regions of Moderate Precipitation.

The length of the freight trains on the Pennsylvania lines running to the west and north-west from Pittsburg is determined by the weather report issued from the Chicago office of the Weather Bureau. If the bulletin of the Weather Bureau forecasts favourable weather the engine's load is placed at 1750 tons, while the announcement of the approach of bad weather limits the load to no more than 1225 tons.

Reports of the resistance of trains during winter and summer are accessible within the limits of 40° and 100° F. The effect of the higher temperature is to decrease materially the amount of loss by friction while the lower temperature increases the loss. The co-efficient of rolling friction at 40° (0·035) is double that at 100° (0·018), and the pounds resistance of trains per ton in the former case is 7, in the latter 3·6.

Tower[1] writes:—"We certainly know of no experimental evidence to the contrary, and the conclusion is that a difference in the rolling friction of cars is the chief reason why trains must be cut down in winter. The effect of difference in the temperature alone, length of train and other conditions being equal, is to increase or diminish coal consumption at the rate of 1 per cent. for each 2° F. difference of external temperature."

Many roads in the northern parts of the United States have built snow fences on the windward side of cuts to protect the road bed from drifting snow. The protection of tracks by snow sheds and snow aprons forms a considerable item of expense in western roads. In an annual report of the president of the Union Pacific not far from 2 per cent. of the entire expenses of the road was credited to removal of snow and repairs of snow sheds.

The Iquique Railroad of Chile reports an increased cost of working during fogs. The dense fog of the winter produces slippery rails, and during this season the tyres of the locomotives are much worn, their average period of usefulness being greatly reduced.

Regions of Light Precipitation.

The invasion of desert regions by railroads forms an interesting study. The dryness of the air has advantages as well as disadvantages. It prevents the oxidation of metal and the decomposition of organic matter. The latter, however, dries up rapidly and crumbles into dust. The railroad ties suffer in this way to a considerable extent. The danger of fire is greatly magnified, and the destruction of the ties cannot be prevented. The Central Asian Railroad crosses a number of wooden bridges. With

[1] *Railroad Gazette*, 1886, xviii. 248.

the insignificant rainfall, the mass of piles becomes as dry as tinder. The lack of wood and coal, and the use of petroleum fuel as a substitute, increases the danger of fire. Six fire stations are maintained along the line, and the bridges are patrolled day and night. The authorities have in recent years been induced to build steel girder bridges.

In the true desert regions railroads seem to have suffered little from disease among their operatives. The Wadi Halfa and Abu-Hammed Railroad of the Nubian desert, with a pay roll of 2000, claimed that no more than 12 men were on the sick-list at any one time, and most of these could be accounted for by accidents. The Arabs say that their only fear is hunger and thirst.

The Transcaspian Road was not so fortunate at the beginning of its history. The climate was considered very unhealthful, teeming with fever which came on very suddenly. By proper care, however, the percentage of men incapacitated never arose above 5 per cent. Ashkabad, the principal centre of the same road, with a great range of temperature, was considered an undesirable station, because of its apparently unhealthful climate, but is now an important point with a population of 7000. Where there is a lack of water we are apt to find disease. Lack of drinking water was the trouble at Ashkabad. The Transcaspian Road obtained temporary water supplies from watercourses crossing the line, water being pumped by hand into tanks raised on piles of sleepers. It was discovered by the officials of the Central Asian Railroad that the scarcity of water precluded the possibility of forming camps at intervals or working in sections, so there was conceived the novel idea of a camp on wheels, which should move onwards as work progressed. Water was provided at Uzunada, the Caspian terminus, by means of a huge distilling apparatus. Streams from distant hills were turned from their courses into reservoirs and thence led by means of pipes to the line. Where this could not be done, large trucks carrying immense wooden tubs brought water from the nearest spring.

On the Iquique Road—mentioned under the previous zone, but really traversing a desert region—it was found necessary to convey water in tanks to several points along the line, and thus to use steam power in hauling tanks instead of a more paying load. From Antofagasta, on the Antofagasta and Bolivia Railroad, for two hundred miles to Calama, not a tree or blade of grass is to be seen. There is no water in the whole distance. A two hours' rain would wash the track out of the canyon in which it is laid, but apparently there is no danger of such a rainfall. The stations are supplied with water drawn from Antofagasta. At this terminus ocean water is distilled for use. In some cases water was carried inland for forty miles on mules.

With the cloudless skies and low humidity the sand of the desert becomes highly heated. We should expect that the length of a working day would be greatly reduced, but the employment of the native people has been of great benefit in accelerating the work in the deserts. On the Transcaspian Road, because of the heat, the working day embraced the hours from 4 A.M. to 7.30 A.M.; from 7.30 A.M. to 10 A.M., and 4 P.M. to 8.15 P.M. Furthermore, the men who were anxious to earn

more money for piece work turned out at 2 A.M., rested from 10.30 A.M. to 1 P.M., and continued their labours until 9 P.M. The Central Asian Road was pushed through the country at the rate of four miles per day. The labourers worked in shifts of six hours each, and were free the remaining eighteen hours of the day, resting in the moving camps.

The entire absence of fuel is a considerable problem in trans-desert railroading. In South Africa the difficulty of obtaining fuel has to some extent retarded the modern means of transportation, although the difficulties have been partially overcome by the aid of liquid fuel. Along the River Plate, the total absence of coal and wood, and the expense of supplying them from a distance, have led the Great South-Western Railroad to use "bosta," dried sheep's dung.

Stories of caravans overwhelmed by sandstorms, and sand dunes attaining in some instances the height of 600 feet, confront the engineer who builds a road through a desert. In the beginnings of the Trans-caspian Road, sand watchmen were stationed to guard against a surprise. The force of sand drifting between the Caspian Sea and Lake Aral is so great that the course of the Oxus, once a tributary of the Caspian, has been diverted into Lake Aral. To guard against drifting, the conical heaps of sand which abound were covered with caps of bundled fagots. Similar masses of plaited brush were scattered at the edge of embankments and along the top of cuts. The fagots soon began to sprout, seeking water that was evidently not far below the surface. This made the vegetation permanent and the line was completely protected from drifting sand. Similar conditions are found on the Central Asian Road. In the blowing of the wind the air becomes charged with sand, which not only blinds the drivers, but also accumulates in deep drifts on the rails. At such times, night running is suspended and detentions of several days are frequent. The remedy was found in the planting of the saxual, a gnarled shrub, that would flourish in the locality and tie down the sand.

Regions of High Altitude.

Like the desert, a mountain system is a barrier to travel, but not an effective one. Travel is not comfortable, nor, in many cases, safe, at high altitudes. On the other hand, the extreme rarefaction of the air at such altitudes prevents to a great degree the decay of the organic matter and the oxidation of metals. Legrand, for the Andes, cites numerous cases in which bodies of animals, and even human remains, were preserved in a thoroughly dry state until resolved into dust and blown away by the winds. Wood is strongly affected by this condition. Thus it was foreseen that in the case of ties it would be necessary to dispense with wood and replace it in all cases with metal.

One of the interesting features of travel at great altitudes is the experience with mountain sickness. Legrand states that in the Andes at an elevation of five kilometres the pressure and oxygen are reduced about 47 per cent. Under this condition active work is attended with considerable difficulty, and one must necessarily become acclimatised before he is able to carry on manual labour with any degree of comfort.

When the railroad up the Jungfrau was proposed, the authorities detailed Dr. Kronecker to investigate the conditions under which the road could be built and worked without endangering human lives. In his report Kronecker stated that mountain sickness sets in at altitudes varying with different persons; beyond 10,000 feet it attacks all persons as soon as they indulge in the least muscular effort. Persons in good health can stand passive transport to about 12,000 feet without inconvenience; a prolonged sojourn, however, may be disastrous in its effect upon health. He further recommended that all guards and officials of the road should be carefully selected, and, if possible, acclimatised, or frequently changed between stations. The difference of air pressure between the top and the bottom of the Jungfrau is one-third of one atmosphere, and the running time will allow two hours for the traveller to adjust himself to the change. In the Callao, Lima, and Oroya Railroad many thousands of labourers lost their lives during the four and a half years that this work was progressing. Contractors imported labourers from Chile, and the men, unaccustomed to the climate, were attacked by fever, and the number of deaths reached 1000. Many more suffered from soroche, a disease common on the lofty plain of the Andes. So difficult was it to work in the rarefied air at high altitudes that riveters did not average a week's work each; many returned on the next train. The road rises to 15,666 feet at Oroya. It is stated that the five-mile section of the railroad near Aqua de Verrugas is built through the graveyard of the operatives, whose only monument is the road itself. On the Antioquia Railroad the men worked under a condition which alternated between the blistering rays of a tropical sun and a heavy rain. A different condition is reported on the Sierra Leone Railroad. The number of deaths and of invaliding was wonderfully low, most men coming away not a jot the worse for the experiences; yet the climate had an enervating effect, and frequent absences on leave rendered organisation of the work difficult.

In order to avoid climatic difficulties, the builders of the Jungfrau Road provided for an underground line over the whole of the mountain section. The regular blocking of traffic of the roads to mountain tops justifies such a plan. The Jungfrau Railroad, starting from the little Scheideck, climbs gently up to the Eiger, where it enters under the body of a glacier not to emerge until it reaches Jungfrau-joch, four thousand feet up; from this point it again burrows beneath the snow to complete its journey.

The benefit of such a project can easily be appreciated by any one familiar with the snow avalanches of any mountain section. In one locality in Switzerland 1094 avalanches were reported during a single season. More striking still is the fact that during the winter of 1887-88, in Tyrol and Vorarlberg, 2647 avalanches were counted, of which 1355 are called regular—meaning, apparently, of every winter's occurrence. Arched chutes may be built, masonry breast walls or jetties may be constructed, or staggered stakes may be placed with judgment; yet a surface road remains a surface road, subject to the attack of moving snow.

Some idea of the mass of snow that occasionally falls may be gained from the experience of March 1888 on the Gothard Railroad. The road was covered for about 400 feet to a depth of 50 feet, and the entire fall, so compacted that picks were required in its removal, was estimated at 351,000 cubic yards. It is not uncommon for trains to be caught in an avalanche, for the jarring of a passing train may be sufficient to start the body of snow in motion. At Wall Cut, on the High Line Division of the South Park Road, near Wheeler, California, two sections of a train, including four locomotives and a number of cars, were completely buried by the snow.

Many mountain railroads are abandoned during the winter, as the cost of maintenance of way prohibits any effort in fighting the climate. In 1899 the Colorado and Southern Railroad was forced from its high line between Breckenridge and Leadville under the severe conditions that prevailed in January of that year. An official of the Pike's Peak Road writes with a great deal of hope as late as June 29, 1891, that the opening of the road is truly at hand, and explains that "a small army of Italians are to-day shovelling snow near the top and the track is being adjusted from the disarrangement which it suffered from the winter's frost." Some idea may be gained of a Rocky Mountain snow blockade from a report of the Colorado Midland Railroad. From the 27th of January until the 14th of April the company struggled to keep the line open, but without success. The fight was conducted by two large Jull ploughs and a rotary, each propelled by five engines and assisted by a large gang of men. One crew fought the storm 42 hours without release. Two engine crews were rescued from the mountain side after an absence of 624 hours. On the last day, two engines were released that had been frozen in for 73 days. In places the snow banked 30 feet above the bed of the track, and a gang of men on snowshoes is said to have hunted two hours to find the roof of a snow shed. High winds, and the melting and freezing of snow, made labour difficult. Picks were necessary to loosen the frozen mass, and even dynamite was used. The estimated cost of battling the snow was $60,000. Seven hundred and seventy-three men were in the fight, and the February pay roll alone was $26,000. Sixteen standard gauge engines were used in an attempt to force a way through the snow; 10,000 snow shovels were in use during this period; a large outlay was necessary for food; while the Jull ploughs, which were borrowed, were used at a cost of $40 per day. To the expense of reopening the line must be added the loss in the detention of traffic.

Regions of Severe Winters.

Lake Baikal, on the Trans-Siberian Road, presented a problem that had to be solved. The Baikal Mountains did not invite a circum-Baikalian line, and the passage of the lake seemed the only resource. When the lake was open, the ferry could be utilised; but between December and May it was proposed to lay a road across upon the ice, as is done each year from St. Petersburg to Kronstadt. Under such an arrangement the transition seasons would be awkward. The South-

Eastern Railroad, using the Grand Trunk Railroad bridge in Montreal in order to avoid a toll of $10 per car and eight cents per head, in 1892, constructed a winter communication on ice. The work was repeated year after year, and amply paid for itself. Ice railroads mark the youthful stage of lines; when travel and transportation become assured, more permanent foundations are demanded.

The Trans-Siberian Road crosses five large rivers. It was found impracticable to run steam ferries on these, as they are covered with ice for seven months. The period of ice flow coincides with that of the highest level of the rivers. Siberian rivers, running from south to north, are remarkable for a short but strong flow of ice, due probably in part to their northward direction, and in part to a large number of lakes that are a part of the rivers. The condition of the rivers made bridges imperative, and 10,540 feet of structure were needed. Lake Baikal could not be bridged, nor could it be easily avoided. This led to the construction of the *Baikal*, a remarkable steamship of English make, capable of breaking through solid ice 38 inches thick with 5 inches of hard snow on top. On trial, the *Baikal* forced her way through two thicknesses of ice frozen together, aggregating 56 to 65 inches, while the *Ermak*, another ferry, has overcome mixed ice 25 feet thick. Even with such ice-breakers, it is probable that the mountains around the lake will be tunnelled, for Lake Baikal is subject to violent storms and thick fogs.

The number of days during which work is possible is very limited in high altitudes, on account of the cold that freezes the ground and the snow and ice that hinder and prevent progress. In the construction of the Canadian Pacific Railroad snow was found to a considerable depth as late as June in the Rocky Mountains. Kicking Horse Lake, at the head of the pass that bears the same name, was not free from ice until the middle of June. In September 4 inches of snow fell in the valley, and by the 15th of the month the lake was again frozen over, to remain so until the next summer. The Siberian Road suffers but slightly from snow, as the annual amount is small. From the Amur regions to Vladivostok the annual precipitation is not over 20 inches. East of the lake, the winter precipitation is only about 0·5 inches. At Lake Baikal in 1890-91 the actual deepest level of snow was 7 inches. Such a condition, however, allows the ground to freeze. From October to April the soil is unworkable. Under the most favourable circumstances 500 miles of construction per year was considered a good rate. At the western terminus the average number of days below freezing is 173; at Tomsk, 145; Lake Baikal, 175; the northernmost point, 194; Vladivostok, 150; and, deducting the numerous holidays and rainy days, the year comprises about 100 days.

AN IVORY TRADER IN NORTH KENIA.[1]

This handsome volume contains a considerable amount of interesting geographical detail, together with many notes on the life and habits of the natives of the regions traversed by the author in his journey. As the title indicates, the author's prime object was commercial not scientific, and the narrative, from the geographical standpoint, may be described as a study in primitive methods of commerce. When the teaching of geography becomes thoroughly scientific, then "Commercial Geography," often now so needlessly dull, will be studied from the evolutionist's point of view, and the scholar will be shown how the trade of the world has developed from the primitive condition illustrated in this volume. In the country traversed by our author, the change is even now in progress, for his journey started from Nairobi, on the Uganda railway, from the most specialised means of intercommunication as yet known, and extended to regions accessible only to the primitive "safari" (caravan), with its numerous porters toiling beneath their loads, often through the trackless forest. The story is told with a certain naïve simplicity which greatly increases its charm, and certainly conveys an impression of absolute honesty.

Apart from the sociological interest indicated above, the volume is of importance as containing some new information about little-known regions of Africa, both as regards the country and the people. A considerable part of the journey was made along the banks of the Waso Nyiro. Hitherto this river has been believed to rise in the Aberdare Range, and to empty itself into a great swamp called Lorian, visited in 1892 by an American, Mr. Chanler, and by Lieutenant von Hohnel. As this visit was a brief and hasty one, the author made it a part of his original scheme to explore the region of Lorian, a scheme which from the nature of the country proved very difficult to carry out. The existing maps of the lower reaches of the Waso Nyiro proved to be incomplete and unreliable, and as guides were very rarely obtainable, travelling was exceedingly difficult. The river in its lower reaches has a very winding course, and attempts to shorten the journey by cutting off the curves were often fraught with an element of danger, as water was only obtainable from the river, and if its banks were once quitted it was impossible to forecast the point at which it would be again reached. An unpleasant experience of this kind was the crossing of a lava-belt to the west of Mount Sheba (spelt Shebba on the map). Here the start was made from a camp in the vicinity of the river, and the first part of the journey lay over level stretches of sand, dotted with thorn trees, and covered with patches of mineral salts. Presently smooth patches of black lava showed themselves above the sand, and quartzose rocks appeared; finally the cavern encountered a plateau, about twenty-five feet

[1] *An Ivory Trader in North Kenia: the record of an Expedition through Kikuyu to Gallaland in East Equatorial Africa, with an Account of the Rendili and Burkeneji Tribes.* By E. A. Arkell-Hardwick. London: Longmans, Green & Co., 1903.

high, composed of blocks of black vesicular lava, of varying size, which covered the whole surface of the country to a depth of from thirty to fifty feet. The surface was not level, but was covered by little heaps of lava blocks, loosely piled up, so that a careless movement might bring down a great mass of stone. The blocks were highly vesicular, and the ragged edges soon reduced the boots of the explorers to ribbons, while the animals also suffered severely. The crossing was in consequence very slow, while the heat of the sun was terrific. "Its rays beating vertically down were readily absorbed by the lava, seemingly almost causing it to glow in the intense heat, which, radiating afresh from under our feet, gave us the feeling of being slowly baked in an immense

View of the Waso Nyiro.

oven." "The sun rose higher and higher as the morning advanced, and scorched us until it seemed as if we had not a drop of moisture left in our bruised and wearied bodies." Eventually, however, the lava-belt was safely crossed, save by one of the porters who died of exhaustion on the road, and the sandy plain which stretched down to the river reached. Terrible as was this march, it only extended over some six miles in a direct line from camp to camp. Its trying nature was due not only to the necessary detours, the terrible heat, and want of water, but also to the entire uncertainty when water might be again encountered. After this experience, the marches were carried on as far as possible close to the river's bank. The river was fringed with palms, and often flowed through precipitous gorges. A very curious incident of the journey may be related in the author's own words. "I was laboriously climbing a gravelly slope, when suddenly there was a rush and a roar as of a

mighty whirlwind bearing directly down upon me. I looked round in some alarm, as it is very unpleasant being caught in one of these dust-devils with nothing solid to hold on to. To my intense surprise I could see nothing whatever. Not a leaf or a branch stirred, and not a particle of dust or sand rose. The rushing, tearing sound increased in volume, and drew nearer and nearer, finally seeming in full blast not more than twenty feet from where I stood. But nothing stirred; the air was perfectly clear, and everything else remaining still as death. It was a most uncanny sensation. I abandoned the idea of a whirlwind, thinking perhaps there might be a blow-hole in the vicinity for escaping volcanic gases. I searched the neighbourhood carefully under that impression, but found nothing of the sort. Finally, the sound died away. Two or three times after that, during my walk, the same thing occurred. On one occasion I seemed to be standing in the very midst of the whirlwind. It rushed and roared round about me, and I involuntarily gripped a tree trunk to steady myself against the expected shock. But nothing happened; nothing moved." No explanation of this very curious experience was ever forthcoming.

Part of the district through which the Waso Nyiro flows in its lower reaches is fertile and abounding in game, but as it curves round the easterly spur of the Zambo Plateau, the country changes in character, the luxuriant tropical vegetation giving way to scattered acacias and patches of burnt-up elephant grass. The soil shows a similar change, the outcrops of rock and boulders of quartz and gneiss disappearing, and their place being taken by vast stretches of smooth, shining sand, alternating with patches of loose brown earth, very soft and crumbling in character. At first the river was marked by its belt of palms, but as the party approached the region called by Mr. Chanler the Kirrimar Plain, all trees disappeared, and the river flowed sluggishly through coarse, dry elephant grass, between eight and ten feet in height. The region was very desolate, the ground being deeply pitted by tracks of rhinoceros and elephant, and the ditchlike river literally swarming with crocodiles. The natives accompanying the party became very discontented and mutinous on account of the dangers and difficulties of the journey, and the disappointment was great of the explorers when, after reaching an immense sycamore tree, which marked the limit of Mr. Chanler's journey, no signs of Lorian appeared, the river being seen to flow sluggishly onwards, through an apparently interminable extension of the same parched plain. The next day a further march was made down the river, and two of the men were sent further and reported no signs of the swamp, but merely an extension of the same kind of country. The only conclusion which the party could come to was therefore the following:—"In very wet seasons, or after a series of wet seasons, the Waso Nyiro overflows its banks, and covers a portion of the Kirrimar Plain, forming a vast swamp, or more probably a chain of swamps, to which the name of Lorian has been given by the natives." "After a long drought, by which the supply of water brought down by the Waso Nyiro would be materially curtailed, these swamps dry up, those lying up stream, owing to their higher level, naturally drying up

first, and consequently the western edge of the swamp or swamps, called Lorian, would gradually recede more and more to the eastward as the drought increased. At the time of our visit in September 1900, there had been no rain in Samburland for three years, according to the Rendili, and it is therefore quite reasonable to suppose that Lorian, for the reasons enumerated, had receded many miles to the eastward of the point at which Mr. Chanler turned back, having satisfied himself that

Palms on the Waso Nyiro.

Lorian was merely a swamp, and not a lake as he had supposed." The evaporation in this hot climate must be enormous, while on the other hand the appearance of that part of the Kirrimar Plain immediately adjoining the river makes it certain that it has been under water recently.

The return journey to Nairobi was made by the north and west of Mount Kenia, and as the outward journey was made by the eastern side, this meant that all sides of the mountain were visited. The northern slopes proved to be clothed with beautiful forests, and despite Joseph Thomson's statement to the contrary, very well watered. On the western

slopes the party crossed the Waso Nyiro, only a few miles below its source, and found it to be a swiftly-flowing stream, whose pellucid waters earned for it its native name ("clear water"). The stream arising in the Aberdare range, hitherto regarded as the Waso Nyiro, is but an insignificant tributary of the main stream. The river rises, as already mentioned, on the west of Kenia, and then, after reaching the base of the mountain, turns sharply to the north, is joined by the stream which flows from the Aberdare range, and further on by the Ngare Nanuki ("Red water").

The book also contains many interesting notes on the native tribes encountered by the party, perhaps the most interesting being the account of two little-known tribes, the Rendili and Burkeneji, which are both nomads. They wander over the immense tract of desert country, bounded, roughly, on the north by Southern Somaliland, on the south by the Waso Nyiro, on the west by Lake Rudolf, and on the east by the fortieth degree of longitude. They have one or two permanent settlements, but after long drought are specially to be found in the vicinity of the Waso Nyiro, whither they come for water for their vast herds. It was here that after long search they were found by the party. The Rendili generally resemble well-bred Arabs in appearance, being tall and well built, with slim and graceful figures, and light clear skins. In many cases the features are good, and the nose distinctly aquiline. The hair is jet-black, quite straight, and close-cut. In person they are scrupulously clean, and wear nothing but white cloth, mostly of British manufacture, which has entirely replaced the primitive garment of wool. "Coloured cloth," they informed the author on one occasion, "is only fit for women and Masai." Both men and women wear a good many beads as ornaments, but these are not put on in a haphazard fashion, as among the surrounding tribes, but are carefully worked into necklaces and amulets of artistic design. The beads are usually strung on the stiff wiry hair from the tail of the giraffe, but there was a great demand both for iron and brass wire. The women are graceful and good-looking, and the morals of the community stand high. They are passionately devoted to their children, and as the birth-rate seemed low, and the tribe had been recently decimated by smallpox, they were very willing to adopt the children of other tribes. No signs of any definite religion could be made out, but the dead are buried in a sitting position, in a hole in the ground, and a cairn of stones is then piled on the top, a spear being placed upright on the summit. The neighbouring tribes, such as the Masai, Wakamba, and A'kikuyu, on the other hand, do not bury their dead at all, but leave the bodies to the hyænas. The Rendili habit, as the author points out, is the more interesting in view of the differences between these people and their neighbours, and the obscurity as to their origin. It will be remembered that the tribes which at one time inhabited the banks of the Nile in Upper Egypt buried their dead in the same manner, and the author suggests the possibility that the Rendili may be the descendants of the primitive stock which once inhabited the Nile Valley.

The Rendili are very rich in flocks and herds, especially since their

reduction in number through smallpox. They keep camels, sheep, and goats for the sake of their milk, and appear to live very largely on milk,

Mount Kenia from the North (distant about twelve miles).

Mount Kenia from the South-west (distant about thirty miles).

for they are very unwilling to kill any of their animals for food, and only rarely hunt. The exploring party, during their six weeks' stay with

the tribe, lived also chiefly on milk, of which they drank about two gallons each per day. In addition to their goats, sheep, and camels, the Rendili own a certain number of donkeys and horses, used for riding purposes.

The Rendili were formerly a very powerful and warlike tribe, but are now so much reduced in numbers as to depend largely for protection on the Burkeneji. The latter, when smallpox appeared, sent away their young men to separate camps and so saved them, while the Rendili, who required every hand to look after their enormous flocks, were unable to do this, and in consequence suffered very severely. The two tribes now live together, but the relations are remarkable, for the Burkeneji constantly raid the Rendili, who resent, but do not resist this treatment. The Burkeneji are very like the Masai in appearance, wearing their hair in a pigtail and dressing in a similar manner. They are sullen and pugnacious in temperament, and showed themselves very unwilling to trade. They speak Masai, but most of them understand the Rendili language, and they are gradually assuming the dress and so forth of the Rendili. For some very interesting stories of the relations between the exploring party and these two tribes we must refer our readers to the volume itself. Enough has been said here to indicate the scope of its contents. A special word of praise should be given to the illustrations, which are of great beauty and interest, as will be seen from the specimens which by the courtesy of the publishers we are enabled to reproduce.

THE ANTARCTIC EXPEDITIONS.

We publish this month a map illustrating some of the chief results obtained by the British Antarctic Expedition. At a meeting of the Royal Geographical Society, held on June 10, Sir Clements Markham read a paper on "The First Year's Work of the National Antarctic Expedition," of which the following is the *Times* report:—

"Sir Clements Markham, in his opening remarks, said that they did not intend to discuss or to describe the scientific results of the expedition, as they had not the means. All that was reserved for the day when they welcomed the return of Captain Scott and his fellow-explorers to this country. The paper should rather be devoted to an endeavour to understand and to appreciate the high qualities which enabled their countrymen to make the extensive discoveries which were shown on the map. They represented an achievement which was quite unsurpassed in his time. He spoke of the arrangements for the expedition in this country. When the Government was approached with a view to obtaining assistance in June 1899, Mr. Balfour spoke in the strongest terms of the importance of such an expedition, both from a scientific and a national point of view, and he was told that it would be necessary to build a ship specially adapted for the service, among other reasons for the sake of the magnetic observations. An estimate was

submitted to him amounting to £100,000 if the expedition lasted for three years, or £90,000 if for two years. It was decided that the expedition should be for two years. Mr. Balfour promised a Parliamentary grant which amounted to £45,000. The *Discovery* had proved to be admirably adapted for the work. After referring to the management of the business of the expedition, he said that its cost was well within the estimate, and the committee had a balance of £7000 to meet all further expenditure, if the two ships had returned this year in accordance with the instructions. The expedition left New Zealand on Christmas Eve 1901, and entered the Antarctic ice. Her objects were to study the nature of Ross's great ice-barrier; if possible, to discover land to the eastward; to secure various scientific results during the voyage and in winter quarters; and from winter quarters to explore the volcanic region, and to make discoveries to the south and inland to the west. The explorers had carried out these instructions thoroughly and completely. On reaching safe winter quarters the great work of sledge-travelling was begun with some autumn journeys, which were of great use, both for obtaining information respecting the lie of the land and for the acquisition of experience. There was one fatal accident, which was admirably described by Captain Scott, as follows:—

"'Mr. Barne reached the crest of the hills at about noon on March 11 and camped for lunch, during which meal the wind sprang up very suddenly, bringing a heavy drift, the temperature fell, and the party, not experienced in such conditions, suffered much from frost-bites and general discomfort. In these circumstances, and imagining themselves closer to the ship than they actually were, they decided to leave the sledges and make for her. Soon after their start the gale increased, and they were enveloped in a whirl of drifting snow and entirely lost their bearings. Mr. Barne did his best to keep the party together, the more so when it became evident that the slope on which they stood was affording a less and less secure foothold. Before long, however, one of the men, Evans, slipped and disappeared from sight. After shouting and receiving no reply, Mr. Barne, cautioning the men to remain where they were, decided to follow, and very deliberately started to slide down the slope himself. . . . After waiting for some time, another of the men (Quartly) decided to follow Mr. Barne, and was immediately lost to sight. The experience of these three was identical; after the first start they were soon going at a speed which left them absolutely no control of their movements, and this continued for some 400 or 500 yards, until they were suddenly brought up in a patch of soft snow within 15 feet of a sheer drop into the sea. Meanwhile, of the party above, one, Hare, had decided to go back to the sledge to change his footgear, and the remaining five, after a long wait, proceeded along the slope, as they supposed towards the ship, led by an able seaman (Wild). Luckily, Wild had nails in his boots, for, after travelling some distance, he suddenly and without warning (so thick was the snow) found himself within an ace of stepping over the cliff into the sea. He had the presence of mind to shout to the others to stop, which they were all able to do, except poor Vince, who missed his footing, shot past Wild, and was immediately lost to view. . . . With great difficulty

the remaining four men succeeded in retracing their steps, and eventually reached the crest of the hill, whence, taking a more easterly course, they fell on some landmarks and found their way to the ship. . . . A large search party was immediately despatched on their return to the ship, and the siren was kept going. With some difficulty the search party succeeded in finding the sledges, and in the vicinity they found Mr. Barne, Evans, and Quartly half-frozen and wholly dazed. . . . No trace was found of Hare or Vince. A further prolonged search was made on the following day . . . but without result. On the third day I got up steam on the bare possibility of finding an ice-foot below the ice-cliff over which Vince had fallen, and whilst we were preparing to weigh, Hare was seen descending the hill opposite the ship; he was quickly brought on board, and found to be neither frost-bitten nor in any way hurt by his exposure; he had turned to find the sledges, failed to do so, wandered aimlessly about, and finally lost consciousness; thirty-six hours later he awoke, to find himself buried in snow and only a trifle stiff; he imagined it to be the morning after the accident, and was astounded to learn that he had slept through a whole day. On taking the ship around to the scene of the accident we found no ice-foot, and it was evident that Vince must have fallen directly into the sea from a cliff 150 feet to 200 feet in height.'

"Sir Clements Markham went on to say that he was assured that the biological collections were most important, and would form one of the great features of the expedition. A series of meteorological observations for two years, in 77° 50′ S., more than 500 miles further south than any ship had ever wintered before, would be most valuable. In September the early spring travelling began. Royds and Skelton were the chief explorers of the volcanic island on which Erebus and Terror were situated. With four men they were away 21 days. Great results were to be obtained from the southern and western parties. Captain Scott established a depôt 60 miles to the south in a journey of 10 days, from September 23 to October 4. On November 1 he started with 18 dogs, accompanied by Lieutenant Shackleton and Dr. Wilson. They reached 32° 17′ S. and again reached the ship on February 4, after an absence of 94 days. The story would, he said, be told by Captain Scott himself before 18 months were over. The achievement of the western party was only second to Scott's journey. They were 53 days away. All the travelling parties had returned, and the longed-for relief ship *Morning* hove in sight on January 23 last. The arrival of the *Morning* was providential, but she left the *Discovery* with only provisions to last until next January and 80 tons of coal. It would be seen that a second voyage of the *Morning* was absolutely necessary. They had a balance of £7000, and only a small additional sum was needed—namely £12,000. Without it those heroes, who had done so much for science and their country's credit would be in grave peril. They must provide for wages for both ships; send out the means of blasting and forcing the *Discovery* out of her icy prison; repair the *Morning*; and store her with coals and provisions. There are difficulties and dangers yet, but the chief dangers are financial. The discoverers had full faith in us, and were sure that

the needful funds would be found by our Government. Would not the country recognise the services of these men? He felt sure that it would, and that we should yet welcome them all here, after one of the most successful and glorious achievements that have ever adorned our geographical annals.

"The lecture was illustrated by some excellent photographs taken by Mr. Skelton."

From Symons's *Meteorological Magazine* for May we quote the following notes by Lieutenant Royds, in regard to the meteorological observations made by the expedition:—

"We are in a good southern latitude for observations, and without doubt are much influenced by the ice-barrier. Actually in our winter quarters we are protected and sheltered by hills from N. through E. to SSE., and our temperatures are accordingly higher than those recorded clear of the land. The winds, on the other hand, which always blow from the E. and SE., often have a force of four to five Beaufort at the ship, while a mile clear of the land there are only light airs or a calm. Our gales during the winter began from the E., working round to S. and SW., when it blew its hardest, and gradually working back to E. The barometer gave absolutely no warning of gales during the winter, but during the summer the barometer generally falls for a blow. Northerly winds seem most prevalent during the summer months, and I do not think they were ever recorded in winter.

"Mount Erebus has been most useful for recording the direction of the upper air-currents, and the trend of the smoke from the crater was always logged when seen. The upper winds appear to be usually south-westerly or westerly.

"The auroral displays were not very brilliant, but although I have not really gone into the question, I believe we generally got a blow after a more than usually bright aurora.

"During the winter the wet bulb never worked, and always read some degrees higher than the dry; but once the temperature got above zero it was all right. During the winter I made some experiments for humidity by weighing a dish of water (ice) daily, and got some pleasing results which may prove useful when taken in conjunction with the readings of the hair hygrograph. All recording instruments are most troublesome, as they get choked up during blizzards. The Dines anemometers, small and recording patterns, have been at work; but when it is snowing or drifting much the vanes have to be cleared two-hourly. The recording instruments always got choked in the highest wind, so that no record was obtained above 50 miles an hour; but 65 to 70 miles an hour has been indicated here by the Robinson anemometer, which once showed 90 miles an hour off Coulman Island in a howling gale. The sunshine recorder has worked excellently, and we have about two dozen 24-hourly records.

"It was impossible to measure the snowfall, for in the southerly blizzards we could not say whether snow was falling or only drifting, and the gauges were absolutely useless. These blizzards are pretty

specimens of what pranks nature can play, and Heaven protect the man who gets more than a couple of yards away from the shelter of the ship unless he has something to guide him, as the air is a mass of whirling drift (or snow) and you absolutely can see nothing, and unless you can keep your head (as you cannot help keeping cool) you soon find that you are lost.

"According to my calculations, which are rough and from the uncorrected temperatures, our daily mean for the year is about zero Fahrenheit. Even as early as March I got a temperature of -42° on the barrier while doing an autumn journey, and the lowest recorded by the thermometer $1\frac{1}{2}$ miles away from the ship was -62° in August, while on board at the same time it was $-50{\cdot}5^\circ$. The highest readings were 39° in December 1902, and January 1903, and $41{\cdot}5^\circ$ in January 1902. The range of temperature between the monthly maximum and minimum varies from about 30° in summer to about 60° in winter. It is a very remarkable thing that during our southerly blizzards in midwinter the temperature invariably rose sometimes to 19° F., and then fell again to -30° or under as soon as the wind returned to the eastward.

"During the sledge journeys observations were made every two hours to compare with those at the ship, and I think these should prove very valuable.

"The yearly mean of the uncorrected barometer was 29·228 inches, the highest monthly mean 29·542 in November, the highest reading 30·088; the lowest monthly mean was 28·762 in August, and the lowest reading 28·096.

"The high temperature of the southerly wind blowing straight from the Pole at midwinter must not be taken as an indication of a warmer climate farther south. It is probably a Föhn effect due to the thermodynamic heating of air descending from the summits of the great mountain ranges which were seen to the south. Similar phenomena have, however, been observed in the Arctic regions, especially during the drift of the *Fram*, when there were no mountains near, and it may be that a descending rush of air is brought about near the Poles by some other agency."

The German Antarctic Expedition.

On June 2 the German Government received the following telegram from Dr. von Drygalski, the leader of the German Antarctic Expedition:—"The expedition has reached Durban on its way to Cape Town. All well. Have forwarded reports. Address me Cape Town. Ship behaved splendidly." It also received the following telegram from Lorenzo Marques, dated June 1:—"The Captain of the Norwegian barque *Garcia* has delivered to the German Consul at Lorenzo Marques a letter addressed to the German Consul at Delagoa Bay from the Antarctic Expedition, which she met south of Mauritius. The letter runs as follows:—'German South Polar Expedition. On board the *Gauss*.—We wintered well off newly-discovered land in 66° 2′ south

latitude and 89° 48′ east longitude. We are now on the way to Durban. All well.—Indian Ocean, May 5, 1903.'"

This was followed by a more detailed message received from Simonstown, dated June 9, stating that the German Antarctic ship *Gauss* arrived there the previous morning after a successful year's work in the South Polar regions. She intended to remain there for three weeks to refit, and then to sail for home. The vessel showed outward signs of her contact with the ice. On sailing from Cape Town the *Gauss* called at Kerguelen Island, and landed a party, which reached the floating ice on February 14, 1902. The ship was icebound on February 22 in lat. 66½°, long. 90°. New land was discovered, which was named the Emperor William II. Land. This was covered with ice, with the exception of an inactive volcano. The expedition was icebound here for almost a year, and many scientific investigations were carried out during this period. When at last winter quarters were left it was found that the season was too far advanced, and progress was hampered by snowstorms and by darkness. The ship made her way out northward, and left the ice on April 8. She proceeded to Durban, passing Kerguelen Island, and calling at St. Paul and New Amsterdam Islands. The members of the expedition enjoyed good health, there being no case of sickness, accident, or death during the whole cruise. Professor Drygalski speaks in the highest terms of the vessel's behaviour, both in the sea and in the ice. The equipment and provisions, he says, were sufficient for another two years. The expedition did not sight the *Discovery*, or her relief ship. The specimens collected during the expedition are being sent to Berlin.

This news is the more welcome because, as indicated in our last number (p. 252), considerable uneasiness had begun to prevail in regard to the *Gauss*, and the German Government was making hurried preparations for the despatch of a relief expedition about August 15. Fortunately this is now no longer necessary.

The Swedish Antarctic Expedition.

Serious uneasiness has arisen at Stockholm about the fate of Dr. Nordenskiöld's expedition on board the *Antarctic*. Contrary to expectation, the ship has not yet returned to South America. She had not a very large stock of provisions on board, and it is feared that a second winter out might prove disastrous, as the ship's company consists of twenty-seven men all told, one Argentine officer being among them. A plan for a relief expedition under the command of Lieutenant Gyldén of the Swedish Navy, who has previously conducted an expedition to Spitzbergen, has just been formed; 50,000 crowns have been collected by private subscription, and the Riksdag has granted 200,000 crowns for the expedition, which is to start towards the end of August next. The Argentine Government has offered its co-operation. The expedition will be provided with stores for three years. Lieutenant Gyldén has chartered the steamer *Frithiof*, which formerly brought the Baldwin-Ziegler Expedition to Franz Josef Land. The ship, which is capable of making about nine knots, will carry but one scientist, Baron Klinckow-

ström, as the available space is required for holding Dr. Nordenskiöld's men eventually. It is, however, possible that one Argentine officer will also take part in the relief of the *Antarctic*, which itself, as mentioned above, had among its passengers an Argentine officer, M. Sobral.

No news is expected meantime of the Scottish National Antarctic Expedition, which left Port Stanley for the South at the end of January.

PRIMITIVE MAN.—We are requested to state that in Mr. Richardson's paper on the Mentone Caves in last month's Number, the last paragraph on page 287 should read as follows:—

"Mr. Somerville stated to me that in the Caves near Mentone the Mammoth remains were found beneath the skeletons, but that a chipped flint (not a polished) implement had been discovered beside the Mammoth remains, and he did not think it had dropped down from a higher layer, but that it furnished evidence that Man and the Mammoth existed contemporaneously here. This conclusion is strengthened by the Cro Magnon drawing of the Mammoth already referred to."

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

OPENING MEETINGS 1903-4.

COMMANDER PEARY has consented to address the opening meetings in November, when he will receive the Livingstone gold medal.

SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

The second of the subscriptions acknowledged in June was received from Mr. John Rutherfurd, W.S., and its amount was £5, 5s.

Further subscriptions have been received as follows:—

Mr. J. D. Munro, ...	£2	2	0
The Misses Harvey, ...	5	0	0

NOTICE TO MEMBERS.

The Society's Rooms will be closed for cleaning during the month of August.

GEOGRAPHICAL NOTES.

EUROPE.

The Berlin Gesellschaft für Erdkunde.—On Monday, May 4, this society celebrated the seventy-fifth year of its existence by a special meeting and a banquet. At the meeting a report was read on the scientific activity of the Society during

the last five years. Dr. Sven Hedin gave an address on his explorations in Tibet, and Professor K. Sapper one on his studies of volcanic eruptions in the West Indies and Central America.

ASIA.

The Andaman Islands.—Sir Richard Temple's last report on the Andamans is of exceptional interest, for, besides the usual administrative details, it includes the results of the census both of the Andamans and of the Nicobars. The census operations led to the discovery of a tribe hitherto unknown in the interior of North Andaman, and included an attempt to enumerate the aboriginal inhabitants of both groups. This latter was made under many difficulties, but was generally well received by the people, except the implacable Jarawa tribe, who at one time attacked the census party and had to be fired on. The broad results appear to be that while the Nicobar population is what it always was during historical times, and the unfriendly tribes in the interior of the Andamans are not diminishing, nothing seems to check the decline of the friendly Andamanese. The hostile Jarawas are described as on the whole a larger, stronger, and more intelligent people than the coast tribes which have been long known. These Jarawas constantly raid the settlements, and a punitive expedition sent against them last year has given a clear idea of their haunts, an increased knowledge of the forests they inhabit, besides checking their forays. The expedition also explored, to some extent the hitherto unknown forests of South Andaman, and established the fact that the annual murderous raids of the tribe on the settlements had for their main object the seizure of iron for their spears, arrows, and adzes. The Jarawa, apparently, will risk as much to get a piece of iron as a Pathan to get a rifle. As to the difficulties of such an expedition, during which one British officer lost his life in an effort to prevent the unnecessary shooting down of the Jarawas, Sir Richard Temple remarks that "one has to know the Andamanese jungle, its darkness and denseness, the ever-present danger in threading it from a coal-black enemy, noiseless of tread, and armed with noiseless arrows, and the insect pests that inhabit it, to fully appreciate the skill, courage, and endurance shown by the party composing the expeditions. One has also to know the narrow, tortuous straits through the islands, their uneven depth, and the strength of the tides through them, to quite understand what is involved in navigating them at night." As to the convict settlement, only twelve escaped men were at large at the end of the year, out of nearly 13,000 prisoners, and some of these probably perished on rafts at sea in their attempts to reach the mainland.

AFRICA.

A Somaliland Port.—Mr. Malcolm Jones, the Acting British Consul at Zeila, in his annual report recently published, says:—"Zeila is fifteen hours by steamer from Aden. It has a good sheltered anchorage, but only ships of very shallow draught can approach nearer than two miles from the shore. There is a pier of considerable length off which small coasting boats can lie. These sailing craft are very numerous, and no difficulty is experienced by steamers in loading or discharging cargo. A steamer belonging to Messrs. Cawasjee Dinshaw calls at Zeila once a week bringing the mails. There is no telegraphic communication with Zeila. The town is composed of old white stone houses built in the days of the Egyptian occupation. There are many streets of native grass houses. The sea lies on three sides of the town. Beyond the

town stretches the desert, a vast plain that continues unbroken for nearly sixty miles towards Harrar. At a distance of five miles is the oasis of Takosha. Here are the wells which supply Zeila with water. This water is carried daily in skins on camels in charge of old Somali women. Each morning, just before daylight, this necessary and picturesque procession straggles slowly on to the town. The water from Takosha is full of sand, and must be allowed some time to settle before use. Jibouti is about forty miles from Zeila, and is connected by telegraph with Perim. There is a considerable local trade between Jibouti and Zeila, and every day boats sail from Zeila to Jibouti, with goats, sheep, ghee, and charcoal, etc. Harrar is distant from Zeila a little less than 200 miles. A camel post leaves Zeila once a week for Harrar, and at the same interval a mail leaves Harrar for Zeila. This mail takes five days in transit. A caravan can do the journey in ten days or even less, but three weeks is the usual period calculated for its arrival. The route lies across a desert plain, sometimes strewn with rocks and stones. At regular intervals on the marches, after the first three days, there are wells made by digging deep in the sand of the dry river beds. The last portion of the journey to Harrar, from the post town of Gildessa, is over steep cliffs and rocks, very difficult for camels. From Harrar to Addis-Abeba, about 300 miles, there is a telephone. In Harrar there is a British Vice-Consul (unpaid), and all interests of British subjects are most carefully guarded. In these matters Ras Makunan, the Governor, is always ready to assist with his authority. Zeila is well policed by a military force of Soudanese. There is also a civil police composed of Somalis as well as a small camel corps. Life and property are absolutely safe within the limits of the town. In the interior travellers have nothing to fear from the inhabitants in British territory, provided a proper escort is taken. In the summer months the coast is extremely hot. Most natives leave for the interior, and very little business is carried on. The people abandon themselves to the effects of the weather, and consider this as an excuse for contented idleness. In the winter season the climate is not unpleasant, but a damp wind frequently blows, and fever is very prevalent among all classes. There is a hospital and dispensary provided by Government. The hospital assistant in charge is a native of India."

The Exploration of the Victoria Nyanza.—Commander Whitehouse, R.N., has returned to England on sick leave from the survey of the southern portion of the Victoria Nyanza, which has been rendered necessary in view of the steamship services on the lake in connection with the Uganda Railway. Practically the whole of the portion to be mapped is in German territory, and the survey is being made by arrangement with the German Government, which provided a military escort. A great portion of the southern shores of the lake were found to be very rocky, with precipitous hills, apparently with good country behind. A large number of inhabitants was found along the shores, and the islands bore a teeming population of primitive fishing people. Commander Whitehouse, in a statement made to the press, said that the trade prospects on the lake were promising. On the north side there was much activity on the part of Italian, German, and Indian firms. With the recently inaugurated service of steamers round the lake, the quickest route to the Tanganyika region will be by way of the Uganda Railway, and a project is on foot for opening a route from Lake Victoria to the north of Tanganyika to connect with the steamer on the last-named lake. An interesting experiment was recently made of sending large caravans of cattle to Rhodesia from the south of the lake. Discoveries of gold are stated to have been made both in British and German territory along Lake Victoria, one being near the

Lumbas Station of the Uganda Railway at mile 520, and the other in German territory to the east of Speke Gulf. Commander Whitehouse said that a most interesting journey was made by the new steamer *Winifred* round the lake in February, this being the first occasion on which it has been circumnavigated by a steamer.

South African Association for the Advancement of Science.—The first annual meeting of this society, which already has 762 ordinary and 30 associate members, was opened on Monday, April 27, at Cape Town, the Governor, Sir Walter Hely-Hutchinson, being among those present. Sir David Gill, K.C.B., F.R.S., delivered the presidential address. He urged the special claims of science upon the colonies and colonial Governments, and referred to the duties of the Association and to the prospects of scientific progress in South Africa. He also referred to the proposed visit of the British Association in 1905, and the great good which would result from such a visit of scientific men.

AMERICA.

Forests of Canada.—There are three great timber belts in the Dominion of Canada—the northern or spruce fir belt, the southern or commercial belt, both to the east of the Rocky Mountains, and the British Columbia belt, to the west of the Rocky Mountains. In addition there are the forests of the maritime provinces. Of the three chief belts, the most valuable is the British Columbian belt, where occur the valuable red fir or Oregon pine, the red cedar, the western spruce, the yellow cedar, the hemlock, the balsam fir, the western white pine, the western yellow lime, the maple, and the western oak, all in great quantities. The belt extends from the forty-ninth parallel north to the sixtieth parallel, a distance of some 770 miles, and is from 200 to 300 miles wide. The best timber does not extend to the extreme north. That portion is covered with black and white spruce, and constitutes a very extensive pulp-wood region. In spite of the value of its timber, however, the region is comparatively little used, on account of its distance from the markets of the east, and the lack of cheap transportation. The northern belt is of great extent, stretching from the eastern coast of Labrador north of the fiftieth parallel in a north-westerly direction to Alaska, a distance of 3000 miles, with an average width of perhaps 500 miles. The great bulk of the timber in this region consists of black and white spruce, while the other important trees are larch and poplar. The belt has been insufficiently explored as yet, but though it is stated that in the south the trees are of lumber-producing size, yet over most of the area they are only fit for pulp. Of pulp-wood, indeed, the Dominion possesses an almost inexhaustible supply. The southern or commercial belt of timber spreads over a very wide area of territory. It comprises that portion of Ontario and Quebec lying between the forty-fifth and fiftieth parallels of latitude, and bounded on the east by the St. Lawrence, and on the west by the Great Lakes and Manitoba. The region contains a large amount of timber valuable for lumber, but is not an unbroken belt of first-class timber. None of the best timber trees extend further north than the watershed between Hudson Bay and the Great Lakes, approximately the fiftieth parallel of latitude, and many of them find their northern limit far south of this parallel. The forty-fifth parallel cuts out one very valuable species, the black walnut, whose northern limit of growth is the latitude of the city of Toronto, while a few miles north of this parallel is the northern limit of red cedar and white oak. A line drawn from the city of Quebec to Sault Ste. Marie marks the northern limit of beech, while

one drawn from the northern part of New Brunswick to the north shore of Lake Superior will mark the northern boundary of sugar hard maple. Two other species which have their northern limit within this belt are elm and birch. The king of the northern forest is white pine, which, like white cedar and red pine, has its northern limit at the fiftieth parallel of latitude. The belt would furnish an enormous supply of excellent timber were it not for the destruction wrought by forest fires, as well as by improvident lumbermen.—*National Geographic Magazine.*

Curious Salt Pond in Kansas.—In the *Journal of Geography* a descriptive account is given of the Meade Salt Well, a depression which appeared suddenly in March 1879 in South-Western Kansas. The depression is over 200 feet in diameter, and sinks to about 40 feet below the level of the surrounding plain. It lies on the line of the famous Jones and Plumer cattle-trail, and the wagon tracks are still plainly visible, leading directly up to the margin of the depression. It is partially filled with salt water, although the ground water in the wells of the vicinity shows no trace of salt whatever. Further, the water is distinctly stratified. It is about nine feet deep, and is divided into a basal layer of six feet, and a superficial layer of three feet. The latter contains one-third less salt per unit volume than the lower layer, a fact first discovered owing to the sinking of waterlogged twigs, etc., through the first three feet of water, after which they remained suspended. Another interesting point in connection with the well is that its water, at least at certain times, has a high temperature. The author of the description (Mr. George B. Hollister) states that as yet no explanation of this phenomenon has been offered, but a reference to an account of some Hungarian salt lakes in this *Magazine*, vol. xviii. p. 317, will show that the occurrence of two layers of water of varying salinity affords in itself an explanation of the condition. Mr. Hollister indicates that the high temperature is an occasional, not a universal condition, and it would be interesting to have a detailed comparison with the Hungarian lakes. Many other depressions similar in character to the Meade Salt Well are stated to occur in the high plains which stretch across the western part of Kansas.

AUSTRALASIA.

The Cyclone in North Queensland.—Some details have now come to hand concerning the destructive cyclone which devastated portions of North Queensland on Monday, March 9 of this year. The centre of the disturbance appears to have been in Townsville, the principal city of North Queensland (lat. 19° 30′, and long. 146° 45′), but the adjacent towns of Bowen, Ayr, and Charters Towers also suffered more or less severely. Sunday, March 8, was fairly cool, with a strong west wind blowing, but the temperature commenced to rise towards evening, and the heat during the early hours of the next morning was stifling. The barometer fell rapidly to 28·536 in., but there was but little warning before the full force of the cyclone was felt. The power of the wind was very great, sheets of galvanized iron being whirled about in the air like sheets of paper, some being carried out to sea. Similarly great beams of wood and trees were carried about like straws. At its maximum the velocity of the wind was seventy-five miles per hour. The storm reached its height about 2.15 P.M.; after this there was a lull for about an hour, and then the wind again rose, and blew with great though less violence from the south-east. During the latter part of the day blinding showers of rain fell. The damage done by the storm was very great.

Townsville contains about 15,000 inhabitants, and about half the houses were seriously injured, or even destroyed, while almost all the large buildings of the town were much damaged. Though the path of the cyclone was broad, the violent currents of wind were unusually narrow, the result being that the damage was very unequal in the same neighbourhood. During the early part of Monday the waters of Cleveland Bay were driven far back, only to return in a great flood when the wind veered to the east; this flood water swept over the low-lying parts of the country for a mile or more.

Australasian Association for the Advancement of Science.—This Association will hold its next meeting at Dunedin next January, under the presidency of Professor T. W. E. David of Sydney University. The sections and their presidents will be as follows:—(*A*) Astronomy, mathematics, physics, and mechanics, Professor W. H. Bragg; (*B*) Chemistry, Mr. J. Brownlie Henderson; (*C*) Geology and mineralogy, Mr. W. H. Twelvetrees; (*D*) Biology, Colonel W. V. Legge; (*E*) Geography, Professor J. W. Gregory, F.R.S.; (*F*) Anthropology and philology, Mr. A. W. Howitt: (*G*—1) Social and statistical science, president not yet appointed; (*G*—2 Agriculture, Mr. J. D. Towar; (*H*) Architecture, engineering, and mining, Mr. H. Deane; (*I*) Sanitary science and hygiene, Dr. Frank Tidswell; (*J*) Mental science and education, Mr. John Shirley.

POLAR.

Measurement of an Arc of Meridian in Spitsbergen.—Sir Martin Conway gives in *Nature* a summary account of the measurement of an arc of meridian in Spitsbergen which has been carried out by the Swedes and Russians. So long ago as 1826 Sabine advocated this undertaking, and thirty years later the Swedes took up the proposal. It was hoped for a long time that England would join Sweden in carrying out this work, but nothing was ever done, and the years passed. At length, all hope of English co-operation being abandoned, the Swedes turned to Russia, and, in or about 1897, an agreement was come to by the two Governments for a series of joint expeditions to perform the measurement. The work was actually begun in 1898, and concluded in 1902. The observations are now being reduced, and the result will probably be published in 1904.

The southern extremity of the arc is Mount Keilhau, near the South Cape; the northern is Little Table Island. The difference in latitude between the two is 4° 10′. The Russians undertook the southern and easier part of the arc, from Mount Keilhau to Thumb Point, at the south end of the Hinloopen Strait. The Swedes took the northern part. Both nations established winter stations—the Russians in Horn Sound, on the site of the old whaling station of the London Muscovy Company; the Swedes in Treurenberg Bay, close to the Harbour, where Parry's station was established in 1827. Horn Sound is always easily accessible. Treurenberg Bay is not accessible at all in many seasons. The Swedes had bad luck in this respect, and the best part of two seasons had to be wasted in painful efforts to reach their base station.

The year 1898 was devoted to a preliminary expedition by the Swedes. The Russians began work in 1899, and spent the following winter at Horn Sound. They likewise devoted the summer seasons of 1900 and 1901 to their share of the work. The Swedes were not able to finish in 1901, so they returned for one more long and arduous season in 1902, by which the whole undertaking was finally carried to a successful issue. The Swedes measured their base at Treurenberg Bay, the Russians theirs near Whales Point. For this purpose they used the

Jaderine apparatus, in which a wire consisting of Guillaume metal (a steel and nickel alloy), about 25 metres long and 1·7 mm. thick, is supported at a fixed tension on a series of tripods, used in pairs successively. By this means the base was measured in four days, each measurement being repeated four times with two different wires. The limit of error is stated to be not more than one in 400,000.

At the beginning of the season of 1899 the Russians went up to Horn Sound, and began establishing their winter station close to a spot where Garwood and Conway spent a week in 1897, so that it was not, as they imagined, "a spot where for more than two centuries no human being has lived." Here, in fact, throughout the eighteenth and part of the nineteenth centuries the Russians themselves had a trappers' winter establishment. While the houses were building, the observers went for a trip to the north, but the weather was very bad. Then they went round to Wybe Jans Water (which they call Storfiord) to commence the observations of their ten triangles, one of which had a side 130 kilometres long. They found the sea free of ice—an unusual condition to the eastward—and were able to land anywhere with ease. They were astonished at the relatively rich vegetation on Anderson Island. Not until August 6 could they actually begin observations from the signal point at Cape Lee, where they spent twenty days and could only work on three. They had to abandon the place before their work was done. The wintering party settled in whilst the others returned home. The winterers next spring made overland expeditions to Mount Keilhau, and began work there. In June 1900 the other observers returned from Europe. It was several weeks later before the Keilhau observations were complete. Meanwhile others were exploring the interior of the ice-sheet from Klaas Billen Bay, to find a junction signal-point for the Swedes and Russians. They succeeded after forty-five days, and built a pyramid on Mount Tchernycheff, a point first discovered by Conway in 1897. At Whales Head the observations were very protracted, and ice cut the observers off, so that it was long before they could get away. An expedition went overland to relieve them from Low Sound (wrongly called Van Mijen Bay). This was about all that was accomplished that season.

In 1901 the weather was much more favourable. The Russian base was measured near Whales Point. The remaining stations were occupied as far as Thumb Point, and the work completed. A final visit was paid to the abandoned winter station, and the expedition returned home in safety and content.

GENERAL.

Formation of Barrier-reefs and Atolls.—Dr. Alexander Agassiz read a paper detailing his observations on this subject before the Royal Society of London on March 19. He does not attempt to establish any general theory, but confines himself to a description of the different types, and the probable causes to which they owed their formation. As regards barrier-reefs, those of Fiji, the Hawaiian Islands, and the West Indies usually flank volcanic islands, and are underlaid by volcanic rocks. Those of New Caledonia, Australia, Florida, Honduras, and the Bahamas are underlaid by outliers of the adjoining land masses, which crop out as islands and islets in the very outer edge of the barrier-reefs. Some of the barrier-reefs of the Society Islands, of Fiji, and of the Carolines, show that the wide and deep lagoons, separating them from the land mass, have been formed by erosion from a broad fringing reef flat. Encircling reefs, such as characterise especially the Society Islands, hold to their central island or islands the same relation which a barrier-reef holds to the adjoining land mass. Denudation and submarine erosion fully account for the formation of platforms upon which coral

reefs and other limestone organisms may build either barrier or encircling reefs or even atolls, rising upon a volcanic base, of which the central mass may have disappeared as in Fiji, the Society and Caroline Islands.

The next type is that of elevated islands, such as are seen in Paumotus, Fiji, Gilberts Island, and the Ladrones, many of which are composed only of Tertiary limestone, others of a mixture of limestone and volcanic rock. It is possible to follow the changes from an elevated island like Niue, or Makatea in the Paumotus, to an island like Niau, through a stage like Rangiroa, to that of the great majority of the atolls in the Paumotus. The reef-flats and outer reefs flanking elevated islands hold a peculiar relation to them, being partly fringing and partly barrier reef. It is also possible to trace the passage of elevated plateaux like Tonga, Guam, and the islands in Fiji, partly volcanic and partly limestone, to atolls where only a small islet or a larger island of either limestone or volcanic rock is left to indicate its origin. Atolls may also be formed on the denuded rim of a volcanic crater, as at Totaya and Thombia in Fiji, as well as in some of the volcanoes east of Tonga.

In the Ellice and Marshall group and the Line Islands, are a number of atolls whose base is not known, where it is only possible to follow the formation of the land rim of the atoll, as far as it is due to the agency of the trades, or of the monsoons in constantly shifting the superficial material (prepared by boring organisms) which goes to form the rim. Many of the atolls in the Pacific are merely shallow sinks, formed by high sandbanks thrown up round a central area.

Throughout the Pacific, Indian Ocean, and West Indies the most positive evidence exists of a recent moderate elevation of the coral reefs, for there are numerous pinnacles and undermined masses of modern or Tertiary limestone. Similarly the presence within the lagoons of atolls of honeycombed masses of limestone shows the solvent action of the sea upon what was formerly a much more extensive land area than at present. Atmospheric denudation has played an important part in reducing elevated limestone islands to the level of the sea by riddling them with caverns and by forming extensive sinks, often taken to be elevated lagoons.

Closed atolls can hardly be said to exist anywhere, and the land area of an atoll is always relatively small compared with that of the half-submerged reef-flats. This is specially the case in the Marshall Island and Maldives, where land areas are reduced to a minimum. The Maldivian plateau with its thousands of small atolls, rings, or lagoon reefs, rising from a depth of twenty to thirty fathoms, is overwhelming testimony that atolls may rise from a plateau of suitable depth, wherever and however it may have been formed, and whatever may be its geological structure.

The great coral reefs are within the limits of the trades and monsoons and areas of elevation, with the exception of the Ellice and Marshall Islands and some of the Line Islands. The extent of the elevation is shown by the terraces of the elevated islands of the Paumotus, Fiji, Tonga, Ladrones, Gilbert, and West Indies, or by the lines of cliff caverns indicating levels of marine erosion.

It will be seen from the above that Dr. Agassiz's results do not support Darwin's theory as to the origin of coral reefs.

Geographical Research.—In his presidential address delivered at the Anniversary Meeting of the Royal Geographical Society at the end of May, Sir Clements Markham, K.C.B., F.R.S., outlined a scheme, which is to be put into operation by the Society for the Encouragement of Geographical Research. The plan now adopted is the outcome of the afternoon meetings of the Society,

started in 1894, for the reading and discussion of strictly scientific or technical papers. It is hoped that the new scheme will increase the value of the afternoon meetings, and tend to develop the scientific side of geography. The following is an extract from the president's address, outlining the scheme :—"A permanent committee has been appointed to deal with this department of the work of the Society, to be called the 'Research Committee.' It will consist of those fellows, taken from the list of Referees (which includes Fellows who have read papers, published books, or are known to have a special knowledge of any department of geography), who are most interested in, and best qualified to deal with, the subjects which are embraced in geographical research, as distinguished from exploration, in all its numerous branches. The committee will meet for the discussion of such results of investigation as may be brought before it; and the council may be able to set apart a moderate sum each year for the purpose of encouraging such researches among the younger geographical aspirants. Among the numerous lines that research may take, the following have been suggested :— New methods of mapping, surveying, or computing; Discussion of a definite problem of geomorphology (*e.g.* analysis of a river-system or coast-line); Discussion of a definite problem of hydrography (*e.g.* circulation of sea-water in a restricted area); Discussion of a definite problem of meteorology (*e.g.* modifications of general weather conditions by local features); Regional studies (*e.g.* synthesis of the geography of a county, or of a natural unit such as the Fens); Investigation of distribution (*e.g.* of some crop in relation to natural facilities and access to markets; of former forests in relation to existing boundaries; of village and town sites in a district); Mapping of distribution of plant-associations in a given area, or of a human disease in relation to climate and soil; History of the map of some country (*e.g.* the British Isles); Investigation of evidence of physical changes within historical times (*e.g.* the British Coasts; the desiccation of continents); Discussion of the relation of land forms to military movements in a selected area or a chosen campaign; Discussions of the relation of land-forms to the distribution of man; to the distribution of animals in any area; Geographical conditions affecting the development and colonisation of any region; Complete investigations from the geographical standpoint of a limited area of unexplored or partially explored territory.

"There is still ample room for exploration and expeditions of discovery. We have scarcely yet laid down the great lines of the world's geography, and there is work for generations to come in filling in the details, though future exploration must become more and more scientific in its characters. But we ought also to encourage research, for which exploration furnishes the raw material. By the plan now in contemplation we shall develop the purposes of the list of referees by constituting the research Committee; and we shall develop further the object of the afternoon meetings by promoting research, the results of which will place the meetings on a more assured and regular system by creating the necessity for their being more frequent and at fixed intervals."

Meteorological Kites—an Appeal to Yachtsmen.—Under this title an interesting letter appears in the *Times* of June 2, from Mr. W. N. Shaw of the Meteorological Office, which we reproduce in full :—"I desire to suggest that some of the fortunate owners of steam yachts might add a kite equipment to the appliances on board their vessels, and that they should use it to send up self-recording apparatus to register the temperature and humidity of the upper air when suitable occasions arise. Last summer, from the deck of a tug steaming off the west coast of Scotland, Mr. W. H. Dines reached heights of upwards of 12,000 ft.

successfully, and obtained very interesting results that will be duly presented to the Royal Society. He has arranged the driving power and winding gear in so compact a form that they do not occupy more than about ten square feet of deck space, and the kites which he has designed are such that they can be packed flat, and do not require much room for storage. To run out five or six miles of wire with a kite and instruments at the end, and other kites attached at intermediate points, and to get them all back again without mishap is, of course, not quite so easy as dropping an anchor and winding it up again; but Mr. Dines will bear me out in saying that, with suitable apparatus and a little practice, the difficulty is not more than enough to add pleasant excitement to the operation.

"I am moved to make this request by considering—regretfully, I must add, because the aspiration seems unattainable—how much could be added to our knowledge of the atmosphere by a ship equipped for and devoted to atmospheric research, a floating experimental observatory. But the kite observations are of peculiar interest and importance, and I believe they can be organised without serious difficulty. The cost of the equipment is not by any means prohibitive; indeed, in making plans for continuing the experiments off the west coast of Scotland in the coming summer, the cost of a ship to carry the apparatus makes all the other expenses appear almost ridiculous. For the very best of reasons I cannot offer, on my own behalf or on that of the Meteorological Council, to defray the cost; but, if any benevolent yacht-owner would make the attempt, I can promise him not only the gratitude of meteorologists all over the world, but as many interesting hours as he is willing to devote to the experiments. The meteorological observations will only add to the interest which attaches to the sending of a kite up to, and beyond, the clouds.

"There need be no limitation of the locality of the experiments. Records from anywhere over the sea, from the Antarctic ice to the Arctic ice, would be gratefully welcomed. The equator, the tropics, the British or any other seas offer suitable localities. The only difference that could be drawn between different localities may be fairly represented by the difference, if there is any, between 'most desirable' and 'urgently necessary.'

"This country is sadly behindhand in its knowledge of the upper layers of the air over its many lands; that knowledge, I hope, may come in time; but, even if it be unattainable, we shall make up our leeway, and take the position that we ought to take in such matters, if we present to the scientific world a knowledge of the upper atmosphere of the sea."

Soil Nitrification and Mosquitoes.—Under this title an important paper is contributed to a recent number of the *Lancet* by Dr. Waddell, of Potter's Bar, who describes a series of experiments showing that the presence in water of even a very minute quantity of ammonia is fatal to mosquito larvæ, and leading to the conclusion that, while ammonia is a poison to them in all its combinations, the contained nitrogen unit is the index of effectiveness. He infers that in the effective nitrification of the surface waters and vegetation through the medium of the soil we have a force of enormous potentiality in the crusade against malaria, and one which is capable of practical application. Nitrification may be brought about in two ways—first, by the direct application of nitrogenous manures, and secondly, by fostering the growth of certain plants belonging to the leguminosæ, which are known by their peculiar root action to add to the nitrogen in the soil through their relations with certain earth bacteria. The growth of these plants may be encouraged by the use of phosphatic manures, and also by treating the ground and the seed to be sown upon it with cultures of the earth bacteria

referred to, which are sold commercially under the name of "nitragin." Dr. Waddell calls attention to the inhibitory influence of ammonia upon various low forms of animal life, and suggests that his culture methods might be tested upon a large scale both in India and in the Campagna. They would have the incidental advantage of being in themselves profitable, and he thinks it probable that the methods of modern agriculture may have largely co-operated with drainage in bringing about the disappearance of malarial fevers from this country.

COMMERCIAL GEOGRAPHY.

The Pearl Fisheries of Ceylon.—Advices from Colombo state that the pearl-fishery, which was prosecuted this spring after a barren interval of eleven years, closed at the end of April with a very successful yield, the value of the pearls obtained being estimated at £55,000. Only on five previous occasions during the period of British rule has this total been exceeded—viz., in 1797, 1798, 1808, 1814, and 1891, and since three or four productive seasons usually come together, it is anticipated that the fishery will be successful during the next few years. The pearl banks or "paars" are situated on the wide, shallow plateau that occupies the upper end of the Gulf of Manaar, off the north-west coast of the island, extending to about twenty miles from land. They are the property of the government, and are strictly preserved. One-third of the pearl oysters taken go to the divers as their share, the government receiving the other two-thirds, which are sold by auction. The number of divers employed, mostly Tamils, was 6600, with two hundred boats, which were divided into two squadrons, working alternately at the banks. The pearl fishery always attracts a motley population—native jewellers, pearl merchants, and bankers coming to it from all parts of India, and during the two months the fishery lasts the usually desolate shores at Marichikaddai become a hive of industry, a mushroom town of huts and tents, with shops, bazaars, hospitals, etc., springing up. Great precautions require to be taken to prevent the outbreak of plague and cholera which on some occasions have brought the fishery to an abrupt termination. Owing to the frequent failure of the pearl fishery, the government of Ceylon last year invited Professor Herdman, F.R.S., of University College, Liverpool, to make an examination of the banks, and report on the probable causes of the failure and the remedies that might be applied. The investigation is not completed, but in a preliminary report it is stated that on the most important bank, at least, the oysters may be overwhelmed by natural causes due to the configuration of the ground and its exposure to the south-west monsoon. A marine laboratory under the charge of Mr. Hornell, Professor Herdman's assistant, has been established at Galle for the investigation of the life-history of the pearl oyster and the formation of pearls. It has been already shown that most of the pearls are produced by the irritation caused by the presence of parasitic worms. (Cf. this *Magazine*, p. 205.)

British Trade with Turkey.—Some details given in his latest report on Turkish trade by our vice-consul at Constantinople are curious and instructive. It appears that the Board of Trade returns of the trade between the United Kingdom and the Ottoman Empire are invariably less than those of the Turkish Customs, the latter being about forty per cent. more than the British statistics. The reason is that the import duty of 8 per cent. is paid on the Turkish valuation, which is accordingly made as high as possible, so that the true duty is about 11 per cent. Further, it appears that British trade with Asiatic Turkey is very much larger than with Turkey in Europe. In 1901, out of a total of British imports of over 7¼ millions sterling, over 4¼ millions went to Asiatic Turkey. The vice-consul

points out that cotton goods are by far the most important of our exports to Turkey. In 1901 British cotton goods and yarns were imported to the value of five millions, or about 70 per cent. of Turkish imports from Great Britain. He observes that in our cotton yarn trade Turkey is our third most important customer, Germany and Holland being first and second, while in our piece goods trade Turkey is also third in order of importance, China and India being before her. About two-thirds of the total of the large imports of British cottons go to Asiatic Turkey. The trade in cotton goods between Italy and Turkey is increasing rapidly; in 1897 the imports of Italian cottons amounted to a little over £200,000; in 1901 they were more than £820,000. The imports from Germany, Austria-Hungary, and France were very much less. The Italians not only give favourable terms as to credit, but they have succeeded in producing a printed flannelette which has become very popular in Turkey amongst the people, who wear these raised cotton goods, printed in certain favourite colours and patterns, for shirts and underclothing in winter. It is said that 80 per cent. of the cotton goods sold in Constantinople in winter consists of these raised flannelettes, which are mostly of Italian and German origin. Great attention has to be paid to the colours, which must be fast—a matter to which the Turkish women attach much importance. Patterns of these goods have been sent to the Association of Chambers of Commerce. In the trade in woollen goods with Turkey, Austria-Hungary comes first, Great Britain and Germany coming next, very close together, but a long way behind Austria. The figures in 1902 were:—Austria-Hungary, £612,000; Great Britain, £396,000; Germany, £390,000; France, £208,000. The vice-consul thinks that British manufacturers could secure much more of this trade if, in place of trusting to Armenian houses as at present, they combined and sent out a representative of their own, as the Continental manufacturers do. In the export trade the United Kingdom stands first, taking about six million's worth in a total of fifteen millions. Grain (mainly barley) accounts for over one and a half of the six millions, and wool for about one million, while the other chief exports from Turkey to this country are raisins, valonia, opium, and carpets.

NEW BOOKS.

EUROPE.

The Highlanders of Scotland. By the late William F. Skene, LL.D., F.S.A. Scot. Edited with excursus and notes by Alexander Macbain, M.A., LL.D. Stirling: Eneas Mackay.

Few books have had more influence on our notions of the Celtic history of Scotland than this work of the late Dr. Skene, which was originally published in the year 1836. When written, the author warned his readers that much of what he advanced was opposed to generally received opinions. Skene's view was that the Picts spoke a Gaelic language. It is well known that many of the views advanced in his early work were modified in his great *Celtic Scotland*, published forty years later, yet he still held that the Pictish language was a variety of Gaelic. Modern Celtic scholars have not shared this opinion, and it was well that a new edition of Skene's *Highlanders* should be edited by one of our foremost Celtic scholars. In this edition, which is of particular interest and value, Dr. Macbain, in an excursus on the ethnology of Celtic Scotland and in a series of notes, points out where many modern Celtic scholars join issue with Skene's opinions. It must, however, be owned that the editorial notes do not, on

many occasions, entirely elucidate doubtful points. A good example of this fault is to be found in the following. On page 36 the text reads: "Conall, on his defeat by Constantin, appears to have adopted the usual policy of the northern Picts, and immediately to have entered into a league with the Dalriadic Scots; for we find him in 807 fighting in Dalriada, having attacked the possessions of the southern Picts in that territory, although unsuccessfully, as he was killed in Kintyre by Conall, the Pictish prince there." The editor's note to this passage (page 403) is as follows: "The Pictish prince of Kintyre! What an inversion of facts is here!" This note does not elucidate matters; it is a mere comment, and the reader, unless he have some special knowledge of the subject, is unable to decide wherein Skene is wrong. Another example of the incompleteness of Dr. Macbain's notes is to be found in the following. On page 141 Skene writes: "The use of the harp appears to have rapidly declined in the Highlands during the seventeenth century, in consequence of the civil wars which commenced at that period, and at length it was entirely superseded by the more martial instrument, the bagpipe, the origin of which is altogether unknown, although, from the character of the music, there is greater probability in supposing it an ancient instrument of the Highlanders than of foreign introduction." Dr. Macbain's note to this passage is as follows: "The Bagpipe: 'origin unknown.' That is not so. It came to Scotland in the fourteenth century and reached the Highlands in the sixteenth century, where it was hospitably received. Major (1521) does not mention it among Highland musical instruments, but Buchanan, fifty years later, says the Highlanders used it for war purposes. They also improved it by adding the big drone, whence the 'Piob Mhór.' It is thoroughly non-Gaelic by origin." The editor contradicts Skene's statement that the origin of the bagpipe is unknown. But the reader is left to himself to find out the real facts of the case, which is that the bagpipe was known to the early Hebrews, Greeks, and Romans, and appears on their sculpture and coins. This is a small matter, but it serves as an example of the editorial failing.

An index to the work was badly needed, and Dr. Macbain has added a fairly full one, which is of great use to the student. But even the index is not without faults. For instance, Conall finds no place in it; "Nectan" of the text is "Nechtan" in the index. This last may seem a small fault, but it is one which is apt to mislead. The book, which contains a portrait and a very brief biography of Dr. Skene, is well printed and handsomely produced.

A Tour in the Highlands and Western Islands of Scotland in 1800. By Dr. John Leyden. London and Edinburgh: William Blackwood and Sons, 1903. *Price* 6*s. net.*

By a strange chance this narrative has come to light a century after it was written, and proves to be of great interest. In the autumn of 1800 Dr. John Leyden with two young Germans made a tour which embraced not only the more populous parts of the Highlands, but also something of the "rough bounds." His main objects of inquiry were Ossian and geology, but his observations touch all subjects, and he is always keenly interested in his surroundings. He saw the unfinished Crinan Canal and the "naked" Falls of Bruar, and has notes of numerous vitrified forts. He records without comment the ravages of the water horse, which was described to him as a species of Minotaur. He delights in the scenery, which in his narrative appears as more wooded than it does in some others, and incidentally he gives vivid illustrations of the lack of travelling facilities. The book is excellently edited by Mr. James Sinton, who appends a Bibliography of Leyden's writings.

A History of Scotland from the Roman Occupation. Vol. II. By ANDREW LANG. Edinburgh and London: William Blackwood and Sons, 1902.

The first volume of this history was reviewed at length in this *Magazine*, vol. xvi. p. 656. The present volume covers the period between the death of Cardinal Beaton and that of James VI., probably the most debateable period of Scottish history, and therefore one that appeals strongly to Mr. Lang. He tells the familiar story with a wealth of detail, and is able to throw fresh light on several of the many obscure points, as, for instance, the motives which guided Lethington's tortuous policy in the later years of Queen Mary's reign. It is the obscurities and mysteries of history which specially fascinate him, and to the attempt to unravel these he devotes space which might more profitably have been given to subjects of wider moment. Thus the story of the Gowrie Conspiracy is told with a detail more suitable to Mr. Lang's separate Monograph than to a general history. We may mention in passing that he does not give the erroneous account of the Gowrie coat-of-arms which appears in the Monograph. Moreover, in such discussions he is unwilling to allow a fact to speak for itself. He must always point the moral, and, in doing so, seems sometimes to strain the fact. He has strong personal inclinations, which, for example, do not favour John Knox, and do favour King James VI. Several of his criticisms upon the former's actions have been effectively countered by Dr. Hay Fleming, and some modification of Mr. Lang's attitude is necessary to accuracy. On the other hand, his account of James VI. is an excellent piece of work, and one is glad to find this much-abused monarch so fairly and so favourably portrayed. Mr. Lang's attitude towards Queen Mary is both chivalrous and discriminating. Throughout the volume, even more than in the earlier one, we note Mr. Lang's admirable qualifications for his undertaking, his untiring industry, his deep and intimate knowledge of his subject with its vivid presentation and unfailing personal interest. We miss the breadth of view which, for instance, distinguished Tytler's work, but we must take it that the aims of the two historians were different.

ASIA.

Journey to Lhasa and Central Tibet. By SARAT CHANDRA DAS, C.I.E. London: John Murray, 1902.

This book describes a journey of exploration from Darjiling through Tibet to Lhasa. Sarat Chandra Das received his education in the Presidency College at Calcutta, where he became favourably known to Sir Alfred Croft, the present Director of Public Instruction of Bengal, by whose representations to the Indian Government it became possible for him to make his journeys into Tibet.

The journey which the book under consideration describes was made in the years 1881-82. Though Sarat Chandra had obtained permission to visit Tibet, his venture was not without dangers, for he had much to fear from the brigands who infest the passes between Sikkim and Tibet. After some trouble he succeeded in making his way through the Kanglachen pass, reaching Tashilhunpo. That town had been visited twice before by explorers. These were George Boyle and Captain Turner. They were sent during the Governor-Generalship of Warren Hastings, the former in 1774, the latter in 1783. (See an article in the Society's *Magazine* for August 1885: "Explorations by A——k in Great Tibet and Mongolia".) Sarat Chandra stayed at Tashilhunpo for some time, reading, making notes, and studying the sacred books and histories of Tibet. He then went on to Lhasa, the capital of Tibet, where he spent his time making observations on

Tibetan manners and customs. It is the light his book throws on these that makes it valuable. He deals with the religious system of Tibet and the selection of incarnate lamas. He treats of the political relations between China and Tibet. He states that the regular Tibetan army consists of 6000 men, 3000 being under arms, and the other 3000 at home on half pay. The principal sources of revenue of the Tibetan Government, he says, are the family tax and the land tax, the first being usually paid in coin, and the latter in kind. He deals also with the criminal laws. Thieves have to pay from a hundred to seven times the value of the goods stolen. In certain cases the guilt or innocence of parties is decided by the throwing of dice, the person being exculpated who gets the greatest number of points. Important cases of murder, dacoity, and theft are also decided by ordeals, of which there are two kinds—picking out pebbles from a bowl of boiling oil, and handling a red-hot stone ball. According to the laws of Tibet, the interest on money, grain, or any other commodity is 20 per cent.

The jealousy of the Tibetans towards Europeans is supposed to date from 1791-92, when English soldiers were believed to have taken part in the war which followed the incursions of the Gorkhas into Tibet.

The town of Lhasa has once and only once been visited by an Englishman—Thomas Manning in the year 1811 (see article already referred to)—and no European has been permitted to enter it since the French missionaries Huc and Gabet were turned out in 1846, though many have tried to enter. Some native Indian explorers have been there and have described their journeys, but no traveller has given such copious accounts of the place as Sarat Chandra. The concluding chapters deal with the return journey, *viâ* Tashilhunpo to India.

The book is a decided acquisition to the literature of Tibetan exploration. The letterpress is elucidated by two maps, on one of which the explorer's route is marked. There are many illustrations, and also plans of towns, monasteries, and temples. The notes, by the Hon. W. W. Rockhill, are good. Without them the continual flow of Tibetan terms would be perplexing.

AMERICA.

Among the People of British Columbia. Frances E. Herring. Illustrated. London: T. Fisher Unwin.

This is not a book of reference on British Columbia. That is to say, if one were to consult it on any particular subject it is quite likely the information desired would not be obtained. The writer does not set out with any preconceived programme. She simply takes things as they come, and describes scenes and events as they occurred during a period of her life in the country. The first chapter, for example, describes a Chinese funeral, and the last deals with the salmon-canning industry on the Fraser river. An intervening chapter describes the great Passion Play produced in Tableaux by the Chilliwack tribe of Indians, and another a delightful camping excursion just over the boundary line on U.S. soil. Mrs. Herring possesses the gift of descriptive writing of such scenes as these—easy, simple, and vivid. She introduces also just sufficient of the personal element to interest the reader in herself and the family circle in which she lives. The book is not far advanced before we learn of her engagement to one of the family, and the last paragraph tells of her prospective marriage and settlement in Almanda, near San Francisco. She throws out a hint that she may write of her experiences there, and readers of the present work will hope she will carry out her intention.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

The Discoveries of the Norsemen in America, with Special Relation to their Early Cartographical Representation. By Joseph Fischer, S.J. Translated from the German by Basil H. Soulsby, B.A. Royal 8vo, pp. xxiv + 132. With a frontispiece and ten facsimiles of ancient maps. *Price 8s. net.* London: Henry Stevens, Son, and Stiles, 1903.

The Portuguese Expedition to Abyssinia in 1541-1543 as narrated by Castanhoso, with some contemporary letters, the short account of Bermudez, and certain extracts from Correa. Translated and edited by R. S. Whiteway, late I.C.S. Demy 8vo, pp. cxxxii + 296. London: The Hakluyt Society, 1903.

Guide to Switzerland. With 31 maps and 6 plans (*Macmillan's Guides*). Globe 8vo, pp. cvi + 235. *Price 5s. net.* London and New York: Macmillan and Co., 1903.

India, its Administration and Progress. By Sir John Strachey, G.C.S.I. Third edition, revised and enlarged. Demy 8vo, pp. xxii + 515. *Price 10s. net.* London: Macmillan and Co., 1903.

Practical Guide to Genoa and the Rivieras from Ventemiglia to Florence, including Monaco and Monte Carlo. Illustrated. Second edition. Foolscap 8vo, pp. lxxii + 206. *Price 2s.* London: Simpkin, Marshall, Hamilton, Kent and Co., 1903.

Coll and Tiree, their Prehistoric Forts and Ecclesiastical Antiquities, with Notices of Ancient Remains in the Treshnish Isles. By Erskine Beveridge. With seventy-seven full-page illustrations and two maps. Imp. 8vo, pp. xxvi + 206. Edinburgh, 1903.

Norwegian By-ways. By Charles W. Wood. Pp. vi + 384. With 9 Illustrations. Extra crown 8vo. *Price 6s.* London: Macmillan and Co., 1903.

The Island of Formosa, Past and Present. History, People, Resources, and Commercial Prospects. By James W. Davidson, F.R.G.S., Consul of the United States for Formosa. With two maps, Frontispiece in colour, 168 Illustrations from photographs, and coloured reproductions of two Chinese posters. Pp. v + 646. Imperial 8vo. *Price 25s. net.* London: Macmillan and Co., Ltd., 1903.

Physician and Friend: Alexander Grant, F.R.C.S.: His Autobiography and his Letters from the Marquis of Dalhousie. Edited by George Smith, C.I.E., LL.D. Demy 8vo, pp. iv + 218. *Price 10s. 6d. net.* London: John Murray, 1903.

Danish Life in Town and Country. By Jessie Bröchner. Pp. xi + 242. *Price 3s. 6d.* Crown 8vo. Cloth. Messrs. G. Newnes, Ltd., 1903.

Also the following Reports, etc.:—

Report on the Administration of the Province of Assam, 1901-1902. *Price 3s.* Shillong, 1903.

Nærmest Sydpolen, Aaret 1900. By Carsten Borchgrevink. Heft I. and II. Kobenhaeen: Gyldendalske Boghandels Forlag, 1903.

Report of the Seventy-Second Meeting of the British Association for the Advancement of Science, held at Belfast in September 1902. London: John Murray, 1903.

L'Océanographie. Par M. Chas. Sauerwein. Pp. 37. Bordeaux: Société D'Océanographie, 1903.

La Quatrième Campagne Scientifique de la 'Princesse Alice II.' Par S. A. S. Albert Ier, Prince of Monaco. Pp. 5. Paris: Académie des Sciences, 1903.

Sur l'Etat Actuel du Musée Océanographique de Monaco et sur les Travaux qui s'y poursuivent. Campagne Scientifique du Yacht Princesse Alice en 1902. Par le Dr. J. Richard. Pp. 24. Société Zoologique de France, 1903.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th April 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas, Price 3s. each). *Forfarshire.*—Sheet XLI. 9. *Inverness-shire.*—Sheets XXIX. 7, 9, 10, 11, 12, 15, 16. *Island of Skye (Inverness-shire).*—Sheets XLVI. 4; LII. 14; LXIII. 3.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Hebrides (Inverness-shire).*—Sheets 22, 23 (Price 2s. 6d. each). Sheet 28 (Price 2s.). *Islands of Skye, Rum, etc. (Inverness-shire).*—Sheets 38, 60 (Price 2s. 6d. each). Sheets 13, 19, 59, 64, 73 (Price 2s. each). *Orkney.*—Sheets (74 and 75), 89, 118 (Price 2s. 6d. each).

Engraved. *Aberdeenshire.*—Sheets 80, 107; (Price 2s. 6d. each). *Banffshire.*—Sheets 42, 45, 47, 49; (Price 2s. each). *Inverness-shire.*—Sheets 78, 79, 80, 81 (Price 2s. 6d. each). Sheets 48, 90 (Price 2s. each).

Quarter-Sheets, with contours. *Aberdeenshire.*—11 SE. (Price 1s.). *Forfarshire.*—19 SE.; 37 SE.; 38 NE.; 39 SW.; 49 SE.; 50 NE. (Price 1s. each). *Perthshire.*—65 NW.; 76 SW.; 88 SE. (Price 1s. each).

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st May 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas. Price 3s. each). *Island of Skye (Inverness-shire).*—Sheets XXXV. 4, 14; LII. (10 and 11); LXIII. (7 and 11).

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Revised). *Hebrides (Inverness-shire).*—Sheets 17, 18 (Price 2s. 6d. each).

Quarter-Sheets, with contours. *Forfarshire.*—19 NE., 19 SW.; 33 SW.; 34 NW.; 39 NW.; 45 SW.; 51 NW., 51 SW. (Price 1s. each). *Perthshire.*—88 NE. (Price 1s.).

Four-Mile Map by Sheets, hill shaded and printed in colours. Sheets 16, 17 (Price 1s. each).

Scotland—Memoirs.—North Arran, South Bute, and the Cumbraes, with parts of Ayrshire and Kintyre, Geology of (Sheet 21, Scotland). The description of North Arran, South Bute, and the Cumbraes, by W. Gunn, F.G.S.; part of Ayrshire by Sir A. Geikie, D.C.L., F.R.S.; part of Kintyre by B. N. Peach, F.R.S.; with Chapter on the Petrography of the Tertiary Igneous Rocks of Arran, South Bute, and the Cumbrae Islands, by A. Harker, M.A., F.R.S. (Price 4s.).

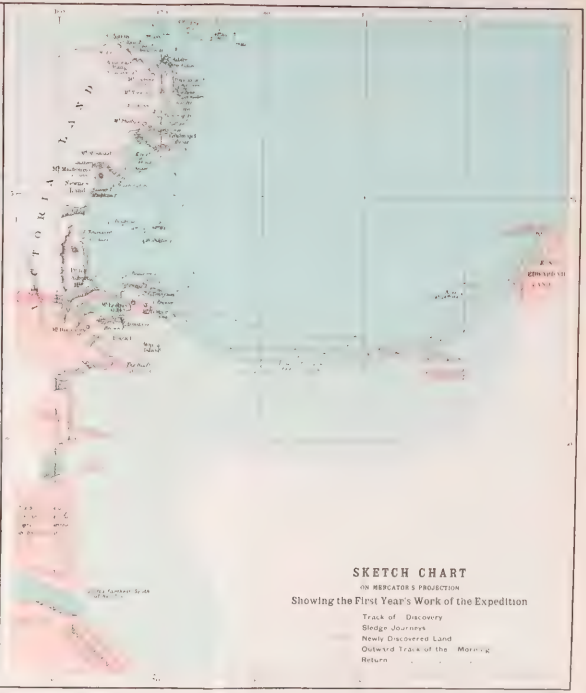
CAPTAIN SVERDRUP'S ARCTIC EXPEDITION IN THE "FRAM." 1899-1902.

THE MAP BEFORE SVERDRUP.

DISCOVERIES OF THE EXPEDITION.

SCOTLAND
on same scale
Edinburgh
Glasgow
Route of the Fram
Sledge Journeys
Newly Discovered Land
GREENLAND
BAFFIN LAND
Ellesmere Land
Grant Land
Heiberg Land
Axel Heiberg Land
Ringnes Land
Cornwall Island
Amund Ringnes Island
Meighen Island
Prince Patrick Island
Borden Island
Lougheed Island
Isachsen Land
Princess Margaret Island
Princess Marie Bay
Cape Sabine
Cape Isabella
Cape Hawks
Cape Parry
Cape Alexander
Cape Combermere
Cape Herschel
Cape Sheridan
Cape Columbia
Cape Colgate
Cape Aldrich
Cape Rawlinson
Cape Hardy
Cape Dudley Digges
Cape Fanshawe
Cape Crawford
Cape Walsingham
Cape Mackenzie King
Cape Storm
Cape Hotham
Cape Garry
Cape Graham Moore
Cape Ellis
Cape Wilberforce
Cape Dyer
Cape Searle
Cape Mercy
Cape Haldane
Cape Warrender
Cape Crozier
Cape Adair
Cape Jackson
Cape Lyon
Cape Kater
Cape Comfort
Cape Hooper
Cape Christian
Cape Fullerton
Cape Low
Cape Chidley
Cape Wolstenholme
Cape Dorset

NATIONAL ANTARCTIC EXPEDITION—THE "DISCOVERY." 1902-1903



THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE RELATIONS OF GEOLOGY.[1]

By Professor Charles Lapworth, LL.D., F.R.S.

We stand to-day at the beginning of a new century. The science of Geology, whose devotees we are, is one of the youngest of the great family of the sciences. The years since first it became conscious of its being are but few in number, and its struggle for existence has from the first been incessant. Yet I doubt not that there are many observers familiar with its history who would assert that "young as it is in years, it is already old in achievements, and that the roll of its discoveries and the number and extent of its conquests stand almost unrivalled for their far-reaching influence upon the philosophy and the practice of mankind."

But it is neither necessary nor dignified on our part here to-day to advance or even suggest this claim. For it is not our self-esteem which prompts our work, or the applause of the world that cheers us in its pursuit. Rather is it the delight in the work itself which animates our labours; and it is in the sympathy and the appreciation of our fellow-workers that we rejoice when our aim is achieved. To Geology and geologists do we stand or fall.

That being so, I have asked myself, as your elected representative, whether it would not be good for us, as a united family of geologists met here together at the close of one era and the opening of the next, to take stock, as it were, of the work which Geology has already accomplished, and note how we are prepared to face the tasks which the new era will demand of our science and of ourselves.

But self-centred though we may be as individual geologists, and self-centred though we may consider our science, we share the common lot of

[1] The President's Address, delivered before the Geological Society of London, at the Annual General Meeting, held February 20, 1903.

all men, and our science shares the common lot of all the sciences. As individuals we receive from our fellow-men all that makes for our social wellbeing; and our science owes its very existence, and most of the conditions that make for its progress, to the aid and sympathy afforded by its fellow-sciences.

We have, therefore, no right to make this prospect or retrospect in the family privacy of our own science, without regard to the feelings or the claims of others. Geology has not only its privileges, but also its duties, and the entire world of science and practice has the right of demanding a justification of the faith that is in us. Nor do I think that it asks too much if it insists upon a categorical answer to the questions:—What is this Geology of which we are so proud and so confident? What has it done for the mental or material benefit of the human race? and on what grounds does it justify its claim to respect and support as one of the factors in the advance of humanity?

Far be it from me to presume to attempt to reply on your behalf to questions of so serious an import. That task must be left in part to the eloquent apologists of our science, and in part to the results achieved by the great workers in geology—results that carry the answer with them. But on an occasion like the present, I doubt whether we can do anything better or more appropriate to the time than have a quiet but open talk together over the position and relations of our science.

Geology and its Fellow-Sciences.

Geology and Astronomy.—In the words of one of the most devoted adherents of our science, we might say "without impropriety, that all the physical sciences are included under two great heads—Astronomy and Geology: the one comprehending all those sciences which teach us the constitution, the motions, the relative places, and the mutual action of the Astra, or heavenly bodies; while the other singles out for study the one Astrum on which we live, namely, the earth."

This definition, if we may call it so, is one which is not only simple and convenient, but it gives perhaps the broadest and clearest view of the place and mission of Geology, regarded from an outside standpoint. And there is a naturalness in this association of Geology and Astronomy which cannot be ignored.

Astronomy concerns itself with the whole of the visible universe, of which our earth forms but a relatively insignificant part; while Geology deals with that earth regarded as an individual. Astronomy is the oldest of the sciences, while Geology is one of the newest. But the two sciences have this in common, that to both are granted a magnificence of outlook and an immensity of grasp denied to all the rest.

Yet, compared with other sciences, few perhaps have so small a number of adherents and working members. It may be that this is due to the opinion of the majority both of the past and the present generation, that these two sciences seem to demand for their successful prosecution an abnegation of emotion and of all human sympathies: their

grandest results are not the conquests of the heart but of the head, wrought out in the cold dry light of reason.

It is needless in these days to insist upon the fierce and pained resistance which both have encountered at almost every fresh advance. In spite of the fact that in the end every such advance has proved itself to be a higher stage in the mental or material progress of mankind at large, there still exists, even at the present time, an instinctive antagonism to Astronomy and Geology in the minds of many, especially from the sides of literature and of philosophy.

The bewildering immensities of space and time with which these two sciences deal, and their insistent claim to be the only authorities that can bring home to the mind of man the awful ideas of infinity and eternity, cause them to be shunned and dreaded by the man of letters, and wring now and again a wail of impotence and sadness from the poet:—

> "What be these two shapes high over the sacred fountain,
> Taller than all the Muses, and higher than all the mountain?
> On these two peaks they stand, ever spreading and heightening."
>
> . . . . . .
>
> "Look in their deep double shadow, the crowned ones all disappearing!
> These are Astronomy and Geology—terrible Muses!"

But while Astronomy and Geology share almost equally in the vague dread which they inspire in the minds of those who look only at Nature from the side of the emotional and the beautiful, they by no means share equally in the admiration instinctively accorded by the average thinking man to the sciences in general. Along the whole range of the concrete sciences there is perhaps not one that has so effectually compelled the respect of men as Astronomy. There is not one in whose progress they have taken so keen an interest, or whose conclusions have been so unhesitatingly accepted. On the other hand, every new discovery arrived at by Geology appears to have come upon the minds of men with something of the nature of a shock. The conclusions of our science seem rarely or never to have been accepted with pleasure because of their value or their grandeur, but rather to have been adopted with reluctance and regret and because they were found to be irresistible.

Yet, after all, this is hardly a matter for astonishment, for it has its root in the origin and the growth of the two sciences themselves. Astronomy had its birth in the childhood of mankind, in the silence and calm of the night, and in the wonder of curiosity and awe. It carried with it from the very first the mystic fascination of the distant and unknown. It was associated in man's mind with the peaceful hours of rest and of contemplation. It held within it much of the enthusiasm and elevation of religion, for it lifted man's eyes upward and heavenward, away from the never-ending struggle in the world below.

Geology had none of these attractions. The world over which early man wandered was to him the theatre of a never-ending conflict, in which were arrayed against him impassable seas, unscalable mountains, gloomy

forests peopled by deadly beasts of prey, raging streams and foaming torrents, each and all the haunts of spirits luring him to doom.

What wonder, then, that Astronomy was one of the first of the sciences to come into being, and that the successive generations of mankind have mingled with an awe of her greatness a tender and respectful appreciation of her work and of her results!

And it was but natural that Geology should be non-existent until long after most of the other sciences had come into being, and some had grown almost to maturity. Even when she at last appeared and thrust herself, as it were, into the established aristocracy of the sciences, she brought with her the stigma of her lowly origin. And to that she added much of the recklessness and assurance of youth, and a bewildering absence of respect for the settled conventionalities of opinion and tradition. This is no excuse; but it is in its way a reason why she is still supposed to be somewhat of a *parvenue* among the sciences, and is often only listened to with patience because of her powers and her genius.

But there is also another reason for the reluctance with which the conclusions of Geology are received by men in general, when compared with the reception accorded to those of Astronomy:—namely, the relative backwardness of the race in its appreciation of the concept of the extension of time as compared with its advanced appreciation of the concept of the extension of space. Note the willingness, and even the welcome with which any average audience of the present day accepts the statements and sympathises with the conclusions of an astronomical lecturer who demands for his remoter starry distances, it may be, myriads of millions of miles. Compare that reception with the coldness, or at all events the smiling incredulity, of the same audience when a geologist suggests for the development of all the geological formations at the very most a hundred millions of years. But it is not only the popular audience, but also the majority of the men of education and experience, who still feel this curious hesitation and difficulty. And nothing perhaps has so retarded the reception of the higher conclusions of Geology among men in general, as this instinctive parsimony of the human mind in matters where time is concerned.

Yet, after all, perhaps this is easily accounted for. It has been well said that "the intellectual advancement of men is due to the relatively small effects of individual experiences added to the large effects of the experiences of the antecedent individuals." The concept of the vastness of space has been familiar to mankind for untold ages, and has grown and expanded with the growth of the race. The concept of the immensity of time has entered so little into the intellectual development of mankind as a whole, and in its grander aspects so recently, that the race is as yet incapable of adequately grasping it.

The wanderings of early man from place to place and land to land soon familiarised him with the idea of the extension of space. He had learned by bitter experience times out of number that the distant horizon which to the eye bounded the vast canopy of the sky above him, was no boundary at all, but shaded away in all directions into a limitless world beyond, whose practical infinity had been proved to him by his

own wanderings, and by those of his forefathers generation after generation. Thus the idea of the vastness of space had already become a part of man's intellectual equipment long before the origin of Astronomy itself. And this idea has been deepened, broadened, and strengthened during the successive centuries of progress by the employment of constantly improving instruments of accurate measurement, by the invention of the telescope, the discoveries of Geography, and by the application of the higher mathematics to Astronomy as a whole.

But early man (and indeed his successors even down to and beyond the Middle Ages) was miserably provided with the experiences which might bring home to his mind the immensity of time. Early man himself had for his longest trustworthy chronological base-line a short seventy years—the span of his own existence—or at most perhaps a hundred years, if he included the experience of his parents. Even in classical times all the past was to his experience vague and indefinite. He had, it is true, mythical traditions of heroic ages, golden ages, and the like, but these when summed up were merely the legendary total of the experiences of but a few generations. Bound down as was man's mind by his anthropomorphic ideas, he naturally assigned to the earth and mankind a correspondingly brief existence; a few generations—a few centuries at the most—must have witnessed its birth; a few generations more must inevitably bring about its death and disappearance. Even since the invention of letters and the compilation of accurate historical records, the period of time of which man possesses experience, either personally or collectively, is at most a very few thousands of years. It is hopeless to expect, therefore, that for a long period to come the geological concept of the immensity of past time will permeate the minds of the many, or that they will accept the conclusions of Geology where time is concerned, with the same confidence as that with which they have long since accepted the conclusions of Astronomy.

But this intellectual backwardness of the race in the matter of the appreciation of the vastness of geological time is not only a stumbling-block in the way of the acceptance of the results of Geology among the public at large, but also to the workers in other sciences, and even to the students of Geology itself. It is well within the memory of many of us how even those holding the most advanced views in other sciences were intensely reluctant to acknowledge the possibility of the existence of man upon the earth for more than a few thousands of years. And among the geologists of the preceding generation, the demand of the so-called "uniformitarians" for those vast æons which must be granted, if the geological formations were accumulated and deposited at the same rate as corresponding accumulations are brought together at the present day, was only reluctantly conceded by the majority after years of conflict and denial. Even at the present time it is the habit not only of eminent physicists, mathematicians, and chemists, but also of some of our geological authorities, to scout all reasonings that suggest a geological antiquity for our globe of more than a few millions of years.

Far be it from me to suggest that geologists should be reckless in their drafts upon the bank of Time; but nothing whatever is gained,

and very much is lost, by persistent niggardliness in this direction. The astronomer, although persuaded of the possible infinity of the universe, is just as careful in estimating the length of his grander base-lines of millions of miles as is the geographical surveyor who takes years, it may be, to measure accurately the length of a base-line a few miles in extent before he commences the triangulation of a single country. But the consciousness of the astronomer of the practical infinity of his realms gives him a freedom of action in dealing with space which is delightful. In the same way the geologist, who is blest with an assured conviction of the immensity of geological time, moves with an ease and freedom from cause to effect wholly denied to those wanting in this conviction. No doctrine in Geology has resulted in such brilliance of discovery as the doctrine of uniformitarianism, which sets no theoretical bounds either to the efficacy of present causes or to the duration of past time. It is not, however, the eternity of geological time that this doctrine demands, but the assumption of the vast duration of the geological periods of which it has been made up. And if to this assumption the geologist adds the conscientious accuracy of the geodesist and astronomer, and not only takes for possible, but absolutely demonstrates by discovery after discovery the true extent of the æons that have gone to the making of the geological formations, he is certain to foster and eventually to establish in the minds of men a full and adequate conception of the immensity of geological time.

Geology in Particular.—I have said that the widest definition of Geology is that it is that science which, leaving to Astronomy the study of the heavenly bodies as a society, devotes itself to the study of the earth as an individual; in other words, that it is a "Geonomy" as contrasted with an "Astronomy." But while this description is justifiable in principle, it is open to the natural objection that it shares this earth-knowledge with many other sciences, especially with the science of Geography. Perhaps the shortest definition that has been made of our science, and one equally acceptable to its students and to those who view it from the outside, is that Geology is the "science of the structure of the earth." It is in and around that earth-structure that all geological ideas centre. In working out the solutions of the problems presented by that structure, Geology not only finds her own special and peculiar mission, but extends a hand to all her sister-sciences.

In studying the solid elements of that structure, Geology shades through the science of Mineralogy into that of Chemistry. In the study of the changes which the parts of that structure have undergone and are now undergoing it shades through the science of Meteorology into that of Physics. In the study of the successive surfaces of that structure it grades into the science of Geography. In the study of the stony relics of the vanished beings that once dwelt upon those surfaces it joins hands with the sciences of Zoology and Botany. In studying the phenomena presented by the sequence and inter-relations of the rock-formations which go to the building up of that structure, it finds the

means of reading the past history of the earth and its living inhabitants —a glory reserved for Geology alone.

It was not until geologists discovered that the solid earth-crust had a structure which was made up of definite parts or "formations" capable of individual recognition and description, each showing a special distribution in space and in time, and each marked by characteristic features capable of being compared, contrasted, and reasoned about, that the science of Geology attained individuality and became worthy of its name. It was this discovery—inaugurated by Lehmann and Guettard about the middle of the eighteenth century, made famous by Werner and his contemporaries towards its close, and established beyond all dispute by William Smith at the dawn of the next—that gave Geology a claim to be regarded as one of the concrete sciences, and placed in her hands the weapons with which she has fought her way onwards irresistibly to the conquest of her kingdom.

Since the days of William Smith, the careful investigation and mapping out of these geological formations, igneous as well as aqueous, has spread outward from the original centres of investigation with extraordinary rapidity, until at the present day there is hardly a civilised nation that does not possess a Government Geological Survey. The fascinating problems presented by these formations and the light which their solution has thrown upon all that concerns the past development of the earth and of its living inhabitants, have not only attracted hosts of enthusiastic students to the science itself, but have given it a far-reaching interest to countless workers in other branches of knowledge and opinion. As a consequence, there is hardly a single important intellectual centre in the Old World or the New which has not its own Geological Society, emulative of our own, whose members are either engaged in aiding the advance of that science or profiting by the benefits of that advance. One and all—national surveyors, members of geological societies, sympathisers in other sciences, collective bodies or isolated individuals—are united in a catholic freemasonry by their common study of, and interest in, the rocky structure of the earth.

I will not attempt the impossible by endeavouring to follow in detail the various stages in the development of geological science, or by trying to distinguish between what is due to the researches of its own students, and what is due to the aids afforded them by the fellow-sciences. But none among us would venture to deny the assertion that no branch of scientific inquiry has profited more than Geology from what has been termed the "consensus of the sciences." No science has received more ungrudging assistance from other sciences, or has repaid more fully that assistance in kind. Almost every problem attacked by Geology has needed the aid of some other branch of knowledge for its solution; almost every advance made by Geology has furthered the progress of one or more of its fellow-sciences.

Geology and Mineralogy.—The discovery of the geological formations themselves may be said to have been essentially the outcome of the early association of Geology and Mineralogy. The brilliant ideas of

Werner, embodied in his so-called "Geognosy," in which these formations were first identified by their mineral characters, and then followed over their vast geographical extension until they were shown to stand related to the whole of terrestrial nature and of life, had unquestionably their root in Mineralogy: and the geological student of the igneous formations is incapable of his task unless he is well acquainted with the latest methods and results of mineralogical science. But the idea of the inevitable association of Mineralogy and Geology must not be pressed too far, nor should it be allowed to give to the whole of Geology that dominant mineralogical colour in which it is often erroneously supposed to be steeped. It is impossible to overestimate the advantages which have accrued to the science of Geology by its association with Mineralogy. But that association is an alliance and not a conquest. Geology is not a province of Mineralogy, but an empire in its own right, and between it and that of Chemistry, Mineralogy is, as it were, a kind of buffer-kingdom having alliances with both.

But if Geology owes much to its alliance with Mineralogy, Mineralogy has benefited by that alliance to quite as great an extent. Not only have all the minerals their home and habitat in the rock-formations, but the mineralogist owes to the geologist all that he knows of their association and distribution. In no branch of our science has Mineralogy aided us more than in that of Petrology, which has made such marvellous strides during the past generation; but that debt of obligation has been well repaid. To the petrologist is owing the discovery of the special association of the minerals in the igneous rocks, their relative order of generation, and their mutual interferences; and following upon this he has made known hôsts of unexpected data rich in fascinating problems, opening out a new world of speculation and research both for the mineralogist and for the chemist.

Geology and Biology.—But if Geology owes the first suggestion of the geological formations and their individualisation to Mineralogy, she has received benefits of as long standing and of as great moment from Biology and biologists. The solid foundations of the palæontological side of Geology were laid by the Continental biologists ranging from Steno to Cuvier, simultaneously with the discovery and the working out of the order of the geological formations. Nothing in the history of the growth of Geology so astonished mankind, or so effectually aided in lifting and dispersing the dark cloud of obloquy and neglect which hid from the world the magnitude of the results attained by the early geologists, as the demonstration by the biologist that the extinct organic remains collected from the geological formations were identical in structure with creatures living upon the earth at the present day, and that all these fossil forms fell naturally into a place in the accepted biological classifications. At every successive stage in the progress of stratigraphy since that time, the geologist has been similarly indebted to the biologist for the interpretation and classification of his fossils; and when we have respect to the rarity and to the fragmentary condition of many of these forms, we cannot sufficiently express our gratitude to Biology for the aid which she has afforded us.

But there is no need to claim that Geology has repaid the debt. It will be enough if I quote here two short receipts handed in on our behalf, one by the most distinguished biologist of the latter half of the century just closed, and another by the present occupant of his chair. In the words of Huxley, "the doctrine of evolution in Biology is a necessary result of the logical application of the principles of the geological doctrine of uniformitarianism to the phenomena of life; Darwin is the natural successor of Hutton and Lyell, and the *Origin of Species* the logical sequence of the *Principles of Geology*." These words were written by him about twenty years since, and his successor, in reviewing from a morphological standpoint a few months ago the work of zoologists accomplished during these twenty years, speaks as follows:—"The progress through which we have passed has produced revolutionary results; our knowledge of facts has become materially enhanced, and our classifications have been to a large extent replaced in clearer and more comprehensive schemes; and we are enabled to-day to deduce with an accuracy proportionate to our increased knowledge of fact the nature of the inter-relationships of the living beings, which with ourselves inhabit the earth. . . . Satisfactory as is the result, it must be clearly borne in mind that its realisation could not have come about but for a knowledge of the animals of the past."

It is at the present day the habit of some to hint that Palæontology, as geologists understand it, is a mere branch of Biology, just as it was the fashion half a century ago to look upon it as a branch of Geology. But the proper view, I take it, is to regard it as the common possession of both these sciences. Here, as in so many contests of opinion, the truth lies in the middle. It is undeniable that all the organic remains discovered by the geologist were in their day members of the great biological chain of life, and have therefore their individual places and relationships in the scheme of biological classification; and that as a consequence the study of their structure and their relationships fall within the province of Biology. But it is equally undeniable that each of these creatures had an existence during a definite range of geological time, and that its fossilised remains occur at a certain horizon in the ascending series of the geological formations. They have thus a geological arrangement and grouping as inevitable and necessary as the biological one. While we grant that the biologist has not only a right but almost an obligation to place in its systematic biological position in his museum an example of every species hitherto discovered by the geologist, it is equally important for the advancement of science in general that the geologist shall have in his museum a stratigraphical grouping and chronological arrangement of fossil species always available for his geological work. There is a phylogenetic grouping by affinity for which the biologist is constantly striving, and to which he is daily more and more approximating; but there is also a chronological grouping by geological position, which for every individual specimen in the palæontological department of a geological museum was practically fixed the day when that specimen was collected from a known stratigraphical horizon. We may rest assured that, year by year, the stratigraphical

classification in our geological museum will become more detailed and more refined. This chronological grouping constitutes a tool with which Geology cannot possibly dispense. Again and again, in the years gone by, the apparent sequence and the known palæontology have been in conflict as to the true stratigraphical position of local formations, and in every known case hitherto the palæontological side has scored the victory.

But indeed, if we geologists were ever to become so benighted as to neglect this detailed sequential classification of the fossils in our museums, the biologists themselves would soon force it upon us for the sake of their own science. Fossils as thus arranged are and can be the only tangible proofs of the chronological order in which the various types and forms of life made their successive appearance on the earth: and they are in consequence the clearest and most widely accepted evidences of the doctrine of biological evolution. And further, the more minutely they are arranged in stratigraphical detail, and the greater the number of species, varieties, or mutations which are arranged under each horizon, the sooner will biologists have at their command the necessary materials enabling them to solve those great outstanding problems that bear upon the laws which have ruled in the origin, variation, and distribution of species.

Geology and Geography.—Turning next to the relations between Geography and Geology, we may say, perhaps, that there are no two sciences more intimately connected, or more mutually beneficial. I have already referred to the natural claim of some geologists that logically Geology includes all that is contained in the study of the earth. But it might better, perhaps, be said that Geology and Geography share much of this collective study between them. Geology deals with the past of the globe and Geography with its present—the former having, so to speak, the charge of its history, and the latter of its politics. The surface of the globe is their common limit, and, in a way, their common property. All that comes above that surface lies within the province of Geography: all that comes below that surface lies inside the realm of Geology. The surface of the earth is that which, so to speak, divides them and at the same time "binds them together in indissoluble union." We may, perhaps, put the case metaphorically. The relationships of the two are rather like that of man and wife. Geography, like a prudent woman, has followed the sage advice of Shakespeare and taken unto her "an elder than herself"; but she does not trespass on the domain of her consort, nor could she possibly maintain the respect of her children were she to flaunt before the world the assertion that she is "a woman with a past."

It is almost superfluous even to hint at the aid afforded by Physical Geography to Physical Geology, or to attempt to show how mutually dependent the two have always been one upon the other. At first Geology was looked upon merely as a branch of Physical Geography; De Saussure, who first gave the name of Geology to our science, was himself in the front rank of the physical geographers of his day. The

study of the whole array of terrestrial phenomena described by the physical geographer is, if anything, even more necessary to the educational outfit of the young geologist than the study of Mineralogy and Chemistry. Without the aid afforded by the study of the present phenomena which properly fall within the ken of the physical geographer, "the conquests of Hutton and Lyell would never have been achieved, and the true philosophy of Geology would have been impossible."

Again, every advance made by the geographical surveyor in the accuracy and details of his maps has resulted in a corresponding improvement in geological mapping and surveying. Every advance made by the descriptive geographer in the discovery, delineation, and description of the geographical relief of continental lands, or of the depths and deposits of the sea, has increased geological knowledge, and has stimulated geological inquiry and discovery in an almost corresponding ratio.

But, in this case of Geography and Geology as in others, the benefits have certainly been mutual. Broadly speaking, almost the whole of that vast mass of information which geographers now possess, respecting the work of those agencies which rule upon the dynamical side of Physical Geography, has been wrought out and accumulated by geologists engaged in searching for the causes of geological action in the past. The grand processes of denudation, erosion, and deposition: the multifarious action of rain, rivers, and ice; the phenomena of earthquakes and volcanoes; and the rock-making activities of animals and plants, were most of them first laboriously investigated by geologists, who welded them into tools for work in their own science, and then handed them over bodily for permanent lodgment in the well-filled storehouse of the physical geographer.

As regards the surface of the earth itself, so numberless of late years have grown the visible and certain points of contact between the phenomena previously regarded as proper to the one or the other of the two sciences of Geology and Physical Geography, and so evident to all has become the sequence of geological causes and geographical effects, that many geographers have of late years almost lost consciousness even of the existence of a possible downward limit to their science. Revelling in the wealth of geological facts and ideas already accumulated and lying ready to their hand, scientific writers have combined with their geographical description of the "forms" of the surface of the earth the geological explanation of their origins in that most interesting branch of knowledge which is sometimes named "Geomorphology." This is undoubtedly a section of geonomic science, which is of great value, and is destined to grow in importance as time goes on. But its study presupposes a preliminary education in which Geology and geological causes take perhaps the largest share; and those who would class it merely as a sub-science of Geography are as wrong as those who class it merely as a sub-science of Geology. It is the healthy and vigorous child of both.

Geology and Physics.—Here we enter upon more difficult and dubious ground, namely, the relations of Geology to the science of Physics,

especially in the matter of the so-called "hypogene" agencies. The mechanical modes and means of formation of our mineralogical rock-sheets have long since been recognised and agreed upon, but the mechanical modes and means of their deformation have, many of them, yet to be identified and established. In the matters of cleavage, jointing, and foliation we have advanced, and in the modes and effects of faulting we have already made some headway. But in the grander problems of orogeny, crust-warping, and secular elevation and depression, we are still very much in the dark. In spite of all the brilliant work which has been done of recent years, we are forced to acknowledge that we are still busied in collecting data upon which to found a philosophic system of crust-deformation. Nothing yet formulated in this direction is of sufficient definiteness and breadth of grasp to afford matter from which anything more than suggestive deductions may be drawn by the higher physics and mathematics.

But although our materials are as yet too heterogeneous and too complicated to admit satisfactorily of such outside analysis, yet among geologists themselves there is being developed a tendency to assort and interpret them from two extreme points of view, which may perhaps be distinguished as the astronomical and the geonomical.

The working theory employed by the many at the one extreme is the collapse-theory, which is founded essentially upon the (contraction) hypothesis of the gradual loss of heat of the earth's interior. This theory starts from the original covering of our globe, and regards the present state of that covering as that of a solid and more or less cooled crust, which warps, folds, and fractures as it follows down upon the slowly contracting, but still intensely heated (and probably solid) nucleus. This crust shows in its structure and in the major forms of the outer surface the combined effects of the radial and tangential deformations due to the contraction and collapse, these deformations being grouped about the remains of the chief irregularities proper to the crust at the time of its original consolidation.

The working theory employed by the few at the other extreme is the fold-theory, founded essentially on the (undulation) hypothesis that the deformation may be largely due to tidal movements and to the constant redistribution of load and resistances. It starts from the known modes of deformation of the rock-sheets which make up the present supercrust and of those of its superposed coverings of water and of air. It regards the earth-crust as a spheroidal shell or bridge surrounding and balanced upon a fluid nucleus (probably gas-like), the shell being in a state of general vibration and its parts in a state of regional and local stress. This shell yields harmonically as a whole; and its various parts yield in groups or individually to the several stresses, but always in theoretic units (duads) each made up of two moieties which are the positive and negative equivalents of each other.

According to both theories, the type of deformation may be that of undulation, warping, folding, gliding, fracture, or flow, according as the magnitude of the stress, the speed of the action, or the relative elasticity of the material may determine: its development may range in time from

that of an instant to that of an æon; and its extent from microscopic to hemispheric.

According to the first theory, however, the deformation is not theoretically symmetrical, but is consequent upon and has ever been controlled by the salient features of the original earth-crust. According to the second, the deformation is theoretically symmetrical, and is due to the continual breaking-down and readjustment of equilibrium; it is at every stage controlled by the length and direction of the instantaneous polar and equatorial diameters of the earth, and by the summational and individual deformations already effected.

The tendencies of the first theory are to compare all the phenomena of yieldage with those characteristic of solid bodies, and to dwell especially upon the proofs of fracture (with the fault as the central type); to parallel such signs of symmetry as are apparent with that of crystals, and the loxodromic trend-lines of the earth's surface with those of crystalline cleavage. The tendencies of the second theory are to compare the yieldage-phenomena with those of flexible bodies (with the fold as the central type), grading on the one hand into those of rigid, and on the other into those of liquid bodies, and including all types; to parallel the symmetries with those of wave-forms, and to refer the trends to composition, interference, or superposition as the case may be.

In the first theory there is inherent the expectation of continuous accretion and discontinuous collapse; in the second the expectation of rhythmic recurrence of form in space and of movement in time. According to the first theory the locus of the pole of the land hemisphere on or about the 45th parallel is an accident of evolution and a survival; according to the second it is a theoretic necessity and a resultant.

How much of each of these views is a mere mental expedient, and how much is an expression of fact, must be left for future research to determine. The discovery of the true path lying between the two extremes will form one of the tasks which await the geologists of the coming era.

Geology and Practice.

Geology and the Useful Arts.—Up to this point I have dealt mainly with the so-called "scientific" aspect of Geology, regarding it from the inside point of view—as an interpreter of Nature, and a member of the great family of the sciences. But, as I have already hinted, we are bound also to consider it from the outside or "practical" point of view—as being one of the servants of mankind and an associate of the useful arts. Indeed it is wholly impossible to avoid dealing with it from this outside aspect. In the words of Herbert Spencer: "Not only are the sciences involved with each other, but they are all inextricably interwoven with the complex web of the arts, and are only conventionally independent of it. Originally the two were one, and there has been a perpetual inosculation of the two ever since. Science has been supplying art with higher generalisations and more completely qualitative pre-

visions; art has been supplying science with better materials and more perfect instruments. . . . And all along this interdependence has been growing closer, not only between the arts and science, but among the arts themselves and among the sciences themselves."

I have already noted how greatly Geology is indebted to her sister-sciences, and how in every case the aid which she has been given has been fully reciprocated and the mutual sympathy broadened and enlarged. Surely there is no need for me to recall how deep and how fundamental are the obligations which Geology owes to the arts in general, and to those of mining, engineering, and topographic surveying in particular. But it may not be without advantage if we geologists remind ourselves of that which in the absorption of our researches we are sadly prone to forget, namely, the existence of those many links that bind our science to the world of practice, and the vital need there is of strengthening those links by every means in our power.

It is true that the first duty of every science is to move incessantly forward from discovery to discovery along the straight path of unremitting investigation and research, following truth whithersoever it may lead, wholly unbiassed by the question as to whether that discovery bears any relation whatever to the material wants of mankind. But it is equally true that once a fresh fact has been discovered, or once a new and satisfactory conclusion has been reached, if that fact or that conclusion be of evident benefit to mankind at large, every lover of his science should welcome its utility and do his best to encourage its use.

Here, however, we cannot ignore the fact that it is impossible that full use can be made of the results of any science until those to whom such results would be of practical value are educated at least in the principles of that science. And such education has a double value; it is not only of especial advantage to those who intend to make use of the results of the science, but it redounds to the benefit of the science itself, for it trains up a host of sympathetic students all concerned in its advancement.

We cannot fail to recognise that those sciences—such as Chemistry, Physics, Biology, and the like—which are generally acknowledged to be most intimately bound up with practice, and an education which is held to be absolutely necessary for success in one or more of the arts or professions, are the sciences which have the greatest number of students and are making the swiftest progress. It is the height of absurdity to imagine that Geology can, any more than any other science, possibly restrict its activity to research alone. Rather may we say that the corporate geological organism has three necessary functions—research, practice, and education. So long as all three functions are naturally and healthfully performed, so long will Geology live and flourish. Whenever either function remains long unexercised, or falls into disuse, there follows, of necessity, a weakness throughout the entire organism, which must in the end become lethargic and crippled, and fall behind in the race.

When, on the other hand, all three functions are most vigorously exercised, the progress of the science must be at its swiftest and its

surest. And this fact has been well illustrated in the history of our science; for whenever these three functions of Geology have been most clearly appreciated and simultaneously energised by its leaders, Geology has shone forth with an especial and peculiar lustre, and has won the attention and regard of the world.

Those who came from all parts of Europe to attend the lectures of Werner, were drawn to him by his conviction that Geology was one of the most useful of trainings not only for the men of the mining and metallurgical world, but also for those who were interested in all that concerns Man's relation to the earth in general. They listened with delight and with profit to the brilliant exposition of his far-reaching ideas, not only because they felt the fascination of these ideas, but also because they were impressed by his assurance of their material and intellectual utility. The geological education which they received from him, they communicated in their turn to their own pupils, and rapidly spread the benefits and influence of Geology far and wide over the economic and intellectual world of their time.

But we have even a more striking instance nearer home. I do not think that it is too much to assert that no single geologist, whose name adorns the long roll of the past members of this Society, secured at one and the same time so far-reaching an influence upon the spread of geological knowledge at large, so sincere a respect for our science from the Governments of civilised countries, and so kindly a regard and affection for it from the mass of mankind, as Sir Henry De la Beche. And I take it that all this was due to the fact that he, more than any other British geologist before him or after him, had a clear and well-balanced conception of the three functions of Geology. He was at once a scientist, a practical man, and an educationalist.

No one familiar with his *Geology of Devon and Cornwall*, or with his *Geological Observer*, but will grant that he was, both from the side of research and theory, a scientist to the backbone. But he was more than a scientist. He was a man whose life-work had convinced him that the useful side of Geology is as important as the intellectual, and indeed of the necessity there is for the constant union of science and practice, or, as he puts it himself, "Science and practice are not antagonistic, they are mutual aids." And mainly, perhaps, because of this conviction, he was also a keen educationalist; for, as he himself expresses it, as "some reason, right or wrong, is sure to be assigned to every practice, it is most important for those connected with that practice that they should possess the existing knowledge upon which it rests."

De la Beche devoted some of the best years of his life to the task of convincing the Government and the people of this country of the importance of the knowledge of the science and practice of Geology and its related sciences to the material and intellectual advancement of the nation. He brought round the Government of the day to his views, and the best minds of his time, from the Prince Consort downward, became his enthusiastic supporters. He created the British National Geological Survey, which has proved itself as beneficial to the advance of pure Geology as it has to the development of the mineral resources of

the Kingdom ; while it has been the prolific parent of similar national Geological Surveys in almost all countries of the civilised world. He founded the Museum of Practical Geology as a national home for the collections made by geological research and for the illustrations of Geology in all its practical applications, consecrating the building, even in its title, to that idea of the combination of knowledge and utility which justified the nation in its foundation and its maintenance. And more, he made that Museum, through his genius and his knowledge of men, a living and growing centre of instruction in geological science and its useful applications, selecting as the teachers of that special education some of the highest intellects of his day.

What other scientific leader of the nineteenth century can show so famous a roll of lieutenants? It is almost invidious to select names from the list. But so long as Natural Science, pure or applied, shall command the respect of men, the names of Thomas Huxley, Lyon Playfair, Edward Frankland, John Percy, Edward Forbes, and Andrew Ramsay, will be held in honoured memory as those of men whose lifework in science, or in practice, or in education, or in all three combined, place them in the front rank of the benefactors of their day and their generation.

We might go on to point out how the success of De la Beche's scheme caused it to outgrow rapidly the limits of its original home, for we are most of us familiar with the fact that while the Geological Survey and the National geological collections are still retained in the original Museum, the educational sections became developed into the Royal School of Mines and eventually into the Royal College of Science, which in its turn practically became the centre of that widespread scheme of national instruction, known as the Science and Art Department. But what especially concerns us here, is that these results demonstrate, on the one hand, the naturalness and fertility of De la Beche's conception of the necessary association of science, practice, and education, and on the other the far-reaching influence that Geology and geologists have had on the extension and invigoration of scientific practice and education in Britain.

Geology and Economics.—It is almost an impertinence to point out to an assemblage of geologists like this the relationships of Geology and its applications to the material welfare of our fellow-countrymen ; but those of us who are absorbed in the charms of research are now and again tempted to look askance at those who are engaged in advancing Geology and the applications of Geology from the side of Economics. Yet for all that, every one of us is well aware that Geology is bound up body and soul with the development of the mineral wealth of our land—that mineral wealth by means of which the enterprise of our people has placed our country at the head of the manufacturing and commercial powers of the world. Our science has not only the charge of the working out of all the detailed phenomena, subterranean and superficial, of the great coalfields and iron-ore fields which lie at the foundation of our commercial supremacy as a nation, but it works out the characters and fixes the places of all the stony materials of which our cities and towns are built, our humblest dwellings are constructed, and all our roads and

railways are made. It deals with the sources and the quantities and characters of our water-supplies, whether deep-seated or superficial, the nature and distribution of our soils, and indeed with everything which we derive directly from the ground upon which we tread. Thus a knowledge of the principles and applications of Geology is indispensable to the education of the miner, the mine-owner, the prospector, the land-agent, the landowner, the agriculturalist, the civil engineer, and the military engineer.

Geology and Man.—It is as true now, as it was in the days when Werner first drew his far-reaching inferences before his charmed listeners, that on the characteristic phenomena and varying distribution of the grand mineral masses of the rock-formations, almost all that concerns the relative habitability of a land depends. Where the hard, intractable rock-formations rise boldly out, we have our mountain regions—our Uplands and Highlands—wild areas of pasture and scanty population, it is true, but the lands of refuge and of freedom in the past, and of health and holiday in the present. Where the soft, easily-weathered rock-formations spread out in gentle slopes or broad undulations, we have the wide plains of our great agricultural districts—the lands it may be of peace and plenty, but where life is so easy-going and so monotonous that there is little incentive or opportunity to vary the established order of things, and the local country-life remains much the same generation after generation. Between these two extremes lie the areas floored by the gently inclined rocks of our great coalfields, the theatres of an incessant and fierce industrial struggle—a struggle that has its reflection and its effects in the restless energy and the determined advance of their inhabitants.

What well-read geologist among us is not aware that every variation in the contour of our country, as it rises from the encircling seas that have guarded our freedom, is dependent upon its geology? Where the hard rock-formations reach the seaboard, project the bold headland and its cliffs. Where the soft rocks come down to the shore-line, open out the broad bays. Where the highly resistant rocks are lifted up in broad mass and face the wild ocean, we find a shore-land of rugged cliffs and wild inlets, inhabited only by a few hardy fishermen. Where the easily yielding rocks have been depressed in mass by geological movements, we have the long-withdrawing estuary, alive with the ships of commerce moving to and fro from the busy and populous seaport at its head.

Or turning inland and looking over the general aspect of the country we recognise everywhere not only the paramount influence of the geological formations and geological conditions on the scenery and the relief of the land; but we trace everywhere the persistent effects of these conditions upon the past and present of the people. All the activities of struggling humanity, in the contest for the bare necessities of existence, for mutual protection, for trade, and for progress, have been limited and controlled by the natural bounds marked out by the unvarying geological factors. The original sites of almost every city and town, village and hamlet, ancient castle and modern mansion, were all determined practically by geological considerations. The sites of the

old fortresses were fixed by the places of the more or less inaccessible cliffs and scarps, the position of the villages and hamlets by the abundance of the springs, and the settlement of the lands by the comparative richness of the soils. All down the long stream of history, the successive waves of invasion, the ebb and flow of conquering armies, the tracks of inland trade and communication, from the time of the Roman ways, through the roads of the Middle Ages and later, down to the main threads of the network of railways of the present day, have all more or less followed the same general courses, courses determined by the geographical phenomena consequent upon the geological structure of the land.

It is idle to pursue these matters further, or recall how all the variations in scenery and scenic beauty are dependent upon geological causes; or how these causes determine the productiveness or the healthfulness of a district. But it is impossible for us, to whom these matters are as familiar as household words, to conceive that the education of the geographer, the traveller, the man of commerce, the student of hygiene, the artist, the archæologist, the historian, or even the politician can possibly pretend to completeness unless that education has shown him something of the wealth of facts and ideas that flow even from an elementary acquaintance with a knowledge of these things.

Here perhaps we may call to mind the fact that what gives character and especial colour to the science of Geology, is that it is the exponent of the idea of continuous evolution. I had almost said the discoverer; for "he discovers who proves." Its widest conclusions are based upon the assumption and proof of the efficacy of small causes to bring about the greatest cumulative effects. There is probably no educational gymnastic more captivating and invigorating than to work out and fully appreciate the quietly cumulative effects of present natural causes —the sea-waves gnawing away the shore, the slow sinking of mud layer by layer on the sea-floor, the quiet burying-up of organisms; next to trace these phenomena backward stage by stage through the rock-formations that mark the æons of the past, down to the very base of the geological scale; and, thence returning, to climb back step by step up the long ladder of life, and note the successive incoming of the ascending types of the animate creation, rising higher and higher yet in the scale of being to the crown of all—Man himself—"the heir of all the ages."

The discoveries which Geology, in company with Archæology and Anthropology, has made in aid of the solution of the great problem of the Antiquity of Man, are so revolutionary and so recent that they are practically familiar to all.

To one who has gone through a geological training, and appreciated its meaning, the idea of slow and continuous evolution becomes as it were part and parcel of his mental constitution. He naturally carries on the same geological methods into the study of humanity in general—always from the developmental point of view, always on the watch for those simple natural causes that may have been capable of bringing about the present known effects, and always in the hope of discovering

a slow and natural evolution. It is in this way that he studies the races of mankind, the growth and relations of languages, the forms and distributions of beliefs, the trends of political practice and opinion, the origin and expansion of commerce. He is watching, and indeed as it were assisting in, the development of a living thing growing up before his mental eyes. His interest is excited, his curiosity piqued, and his emotions stirred; and while his imagination is allowed full play, it is always safely confined within the logical bounds of induction, deduction, and verification.

Surely some kind of knowledge and training of this kind is much to be desired for the ordinary man of education and leisure, the literary man, the arts man, the mathematician. Only by some means of this kind does it seem possible to restore the loss of balance due to the self-absorptive and introspective tendency of much of the so-called culture of the present day. Only by some means of this kind can one attain to the needed breadth of outlook and freedom of opinion as respects all that concerns the relation of man and nature.

Geology and Education.

We have seen that a knowledge of Geology is indispensable to the complete education of the miner, the prospector, the civil engineer, and the military engineer; and that a first-hand acquaintance with at least its elements is eminently desirable for the agriculturalist, the geographer, the traveller, and the biologist. Many may even be willing to admit that the literary man and the man of culture would be the better for knowing something of its principles and its conclusions. But, as geologists, it is our bounden duty to go much farther than this, and urge upon the educationalists of the day the necessity of affording the rising generation such a full opportunity of instruction in that kind of knowledge of which Geology is the keystone as shall enable our youth to understand and appreciate the more important phenomena of the world at large, and the bearing of these upon their own life and surroundings.

Nothing, however, is further from my intention than to suggest that all the youth of the country shall be instructed in the science of Geology as such, or that Geology shall be introduced as a special subject of education, except into the higher classes of schools, colleges, and universities. But what I have in my mind is that Geology is the centre of that group of knowledges which are sometimes collectively referred to as "Nature-Knowledge," and their study as "Nature-Study." The more advanced educationalists have long since suggested and even strongly advocated instruction in Nature-Study for all our youth; but, alas, they are not yet agreed as to what "Nature-Study" shall include, or how it shall be taught. At the one extreme are those who apparently would embrace within it instruction in and explanation of all such concrete facts and phenomena as can be brought before the notice of the youthful pupil so as to direct his attention to external nature in general. At the other extreme are those to whom this dwelling upon facts and

phenomena appears to be repugnant, if we may judge from the following extract which I take from a recently published book-catalogue:—"To those who are striving to make Nature-Study more vital and attractive by revealing a vast realm of Nature outside the realm of science, and a world of ideas above and beyond the world of facts, the pages following, giving the titles of books dealing with Nature and Nature-Studies, are dedicated." As geologists, however, we should presume, I take it, that education in Nature-Study is, in the words of Huxley, "education in that diligent, patient, loving study of all the aspects of Nature, the results of which constitute exact knowledge, or Science."

Education in Earth-Knowledge.—However that may be, this at all events is clear: the branch of Nature-Knowledge with which Geology and geologists have to do is that which Huxley terms "Erdkunde, or Earth-Knowledge, or Geology in its etymological sense." So impressed was Huxley with the general need for instruction in this kind of Earth-Knowledge, that he practically founded for its study the educational subject which he named Physiography. Yet Physiography has come to embrace much that truly belongs to Astronomy; and, indeed, a very large proportion of the subject of Physiography, as taught in many schools and colleges in Britain at the present day, is essentially astronomical. But here we have to bear in mind that of the two great divisions of Nature, that of the outside universe which is proper to Astronomy concerns individual men but indirectly. The other half of Nature, if we may call it so—the world upon which we live and amidst whose phenomena we move and have our being,—is always with us and around us; and its conscious systematic study, which we call "Earth-Knowledge," is in truth only a methodising and an extension of the unconscious and unsystematic study that we call "experience," which we are always making from the earliest dawn of our consciousness to the final darkness of old age. This is the kind of Nature-Knowledge —namely, Earth-Knowledge proper, or in other words "Geonomy" as contrasted with "Astronomy"—of which our youth has the greatest need; and it is instruction in this which it is one of the missions of Geology to claim for the rising generation.

The day has not yet arrived when it will be possible to define precisely what should be taught under the head of this Earth-Knowledge. But what I would understand by it is that it should embrace instruction which would direct the attention of the scholar not only to the natural phenomena of the world at large, but also to those particular phenomena of the world immediately around him. In its general interpretation, its central plane would be the surface of the earth; and from this it would pass upward by proper stages to consider the distribution of all the phenomena, organic and inorganic, above that surface; outward to the study of the meaning and interaction of these phenomena; downward to the study of their history; and onward to the study of their evolution.

The teaching of this Earth-Knowledge could begin in the elementary classes of schools, be continued in rising grades through the higher classes, and thence extended to the universities. Speaking theoretically,

in its earliest stages it should be as simple as possible and cover the ground which is familiar to daily experience or which is fundamental to several of the natural sciences. In its higher stages it should become more specialised, and include the facts and principles common to the special group of sciences which will become of value to the scholar in his later studies or in his after life. In the university it might finally be restricted to the perfect knowledge of that one science which the scholar has selected for his speciality, and as much of the fellow-sciences as has an intimate bearing upon the science which he selects as his own. At every stage a broad foundation should be laid for the superstructure to be erected in the next stage of advance.

But, speaking practically, it is impossible at the present day to lay down any general rules as to the order in which the subjects dealt with under the head of Geonomy should be taken up, or as to the way in which those subjects should be individually treated. For while it is quite true that the aim should be to instruct in those generalities which are common to many or all of the sciences, we should most strictly guard ourselves from falling into the error implied by many of the text-book writers on Physiography, who start with an opening chapter on matter, energy, gravity, and the like—generalities in their essence as yet hardly capable of conception even by the highest intellects. And while it is quite true that the most vivid and lasting means of education is by experiments and deductions carried out by the pupil himself, we should as carefully avoid the equally fatal error of imagining that instruction in a single experimental science, such as Chemistry and Physics, can do more for the pupil than give him a glimpse of a corner of nature.

It is sometimes suggested that instruction in Earth-Knowledge should commence with the simplest facts and deductions, and lead up stage by stage to the highest philosophical conceptions and generalisations. But this is not the way in which any branch of knowledge has grown and developed in the past. The human mind is so constituted that it can often appreciate the broadest generalisations in some directions, before it can interest itself in the most elementary facts and draw the simplest conclusions in others. What must be done is to ascertain, from the study of the several branches of knowledge, how they have individually grown during their developmental history in past ages, note the order of subjects which were earliest and most easily appreciated by the human intellect, and give the successive phases of education as nearly as may be in that order.

Again, it is sometimes hinted that the only fruitful education is that which is purely experimental, the deductions and generalisations in which shall be worked out by the scholar himself; and also that all knowledge which is imparted by the didactic method is not true knowledge, and is comparatively infertile. But I firmly hold that both methods are correct, each for itself, and should both be utilised. There are unquestionably some things which are best taught by experiment, and by that demonstration in which the pupil takes the whole or the largest share. But, on the other hand, the facts of science are so overwhelming in number, and some of its grandest conclusions are so

dependent on the highest extremes of knowledge, that they must be communicated didactically, and must be accepted by the scholar more or less as an article of faith. Indeed the younger the scholar, and the less his experience, the more certain is he to accept as unquestionable truths the assertions of his instructors. It would be the height of folly to neglect the advantages of all this side of a youth's education in those years of his life when he is most qualified to profit by it.

The fact is that in the imparting of Earth-Knowledge, as in any other kind of instruction, both educational methods—didactic and experimental, authoritative and original—should be utilised together. It is a matter for the educationalist to find out what sections of a subject, and what stages of a subject, are best imparted by one method and what by another. The only rule which can be laid down is that the didactic and authoritative method is certain to have less and less effect as the scholar grows older and his experience broadens, and the experimental and original more and more. But there is no escape from the conclusion that it is the common interest of the teacher and the scholar to make use of both methods; for the knowledge of every man—the genius, the scholar, the wise man, and the fool—is alike in this, that it is the sum of that knowledge which is due to his own individual experience, and that portion of the collective knowledge of humanity which is due to the antecedent experiences of his forefathers, and which he has received at second-hand. It is not that the present educational systems are wrong in laying stress on the memorising and the applying of what is already known, but that they are defective in neglecting the individual and original half of a liberal education.

As I have already pointed out, the central plane of Geonomy is the knowledge of the surface of the earth, whose present and whose present conditions belong to Geography, and whose past and evolution belong to Geology. But in the earlier phases of the education of the scholar there can and need be no distinction in his mind between these two sciences; they are rather combined in a geonomic stage—in a generalised organism, so to speak,—destined to evolve and differentiate later on. Yet in this early stage the dominating section of the subject is essentially Geography. As such it presents two very different aspects: the general geography, namely, that of the world and its surface as a whole; and the local geography, namely, the geography of the home and the surroundings of the scholar. The general geography must be taught didactically, with the aid of such lecture-illustrations as globes and maps: and the instruction must be received by the scholar more or less as an article of faith. The local geography, however—and by this I would understand not only the topography of the district, but the geography of the town or village, the playground, and the very schoolroom itself,—should be taught practically at first hand, the data being recognised, collected, and classified, the experiments made, and the conclusions drawn as much as possible by the scholar himself.

Maps as Means and Symbols of Earth-Knowledge.—It is along this local side of Geonomy that some of the most important advantages will accrue

to Geology, and not only to Geology but to all its associated sciences. One of the most necessary qualifications for the geologist and the geographer, and indeed for all students of those sciences and arts in which facts and phenomena have to be arranged in their order of distribution, is a familiarity with the use of maps and a knowledge of how they are constructed. But one of the commonest results of the present modes of giving instruction in maps and map-making in most schools is to cause this kind of knowledge to become distasteful to the learner. And the consequence is that for one fairly well-educated man who can read a good map of his own native district, there are hundreds to whom this is impossible. A detailed topographical map or a geological map is practically a mystery to the average man; and yet the training which would have enabled him to appreciate and enjoy them both might, if given properly in his early years, have afforded him many a pleasant and interesting break in the monotony of his ordinary school-work. He has doubtless been shown in his geographical classes the ordinary maps of the world, and those of the continents and his own country; he has perhaps copied some of them laboriously in manuscript, and very probably passed examinations in drawing them from memory. But they were always more or less dead things to him, because they dealt with lands and districts which he had never beheld, and not with the familiar objects of the school and the home. He has never seen them grow up before his own eyes, built up from facts collected by himself and his fellows.

We should like to see the lower classes of all schools making a map of their own schoolroom and playground. We should like to see the scholars at a higher stage studying and exercised in the large scale 25-inch map of the locality, with the school in the centre; those at a higher stage engaged on the 6-inch map of the neighbourhood; and so on. Stage by stage the scholars might pass to the study of the 1-inch map of the district or county. Then, when once these maps had become familiar objects, the learners should be taken out on occasional excursions into the country with the maps in their hands, and educated in some of the higher grades of that Earth-Knowledge which can only be seen and appreciated in the open air. Later on the scholars might pass to the study of natural agencies, the origin and meaning of landscape, to geology proper, and thence to the study of the intimate relations of nature and man.

But it must be acknowledged that the present lack of this kind of instruction is not to be wholly ascribed to the teachers. Good local maps were, until recently, practically non-existent. The Government Ordnance and Geological Surveys have now made these at great national expense, but so hidden away are they that few except military and civil engineers and surveyors use them freely, and very few have recognised their perfection and importance. Now that these maps are becoming completed, we are beginning to discover that they constitute a most important educational engine. They are still, however, sold at too high a price. When we bear in mind the important fact that each member of a class should be provided with a fresh map at every successive stage,

the cost to parents and school-managers of this branch of geonomic training, as matters stand, would be considerable. Yet we may be sure that this kind of instruction is certain to come about. It becomes, therefore, a serious question whether the Government departments concerned with the surveying of our country could not be authorised to supply these maps to school classes, either as part of the local Government grant or at a very cheap rate. The actual surveying of the country and the preparation of the maps already costs several thousands of pounds annually, which are ungrudgingly paid by the nation. Surely an extra yearly grant of a few scores of pounds to enable the Government map-making departments to supply these maps to schools at a nominal price would be so trivial, whether compared on the one hand with the large grant already made for the original production of these maps, or on the other hand with their educational value to the rising generation, that it would undoubtedly be welcomed by all.

And once our people became aware of the excellence of these national maps, topographical and geological, the demand for them, which is comparatively small at present, would certainly grow. As yet, however, the public are hardly aware even of their existence. A great advance has been made of late by hanging up selected, but unfortunately, not local, portions of these maps in post-offices, with a notice that the maps can be obtained from the local agent. But what are really wanted in all post-offices are framed copies of the 1-inch and 6-inch maps of the locality, hung up so as to be available for reference by all comers; and a copy of each of these and the other local maps kept in stock, together with a simple catalogue of all the national maps and memoirs, any one of which should be obtainable by return of post. The post-offices are, in the very nature of things, the best advertising places in the country; and they are in direct touch with the map-issuing departments of the Government. Once the people become accustomed by means of their school-teaching, and by constant sight of these maps in the post-offices, to regard them as a factor in their daily life, that which is now a luxury for the learned and the few will become more or less a necessity for the general and the many; and they will demand, for themselves and their children, a more intimate acquaintance with that Earth-Knowledge of which these maps are a symbol—a consummation in which the science of Geology will benefit by no means last and by no means least.

Conclusion.—But to what extent instruction in that Earth-Knowledge of which Geology is the soul and centre will constitute an integral portion of the general education during the present century must depend in part on the efforts of geologists, and in part on the enlightenment and emancipation of the educationalists themselves. As geologists, however, we have the assurance, justified by unbroken tradition, that our views will eventually be accepted simply because they are inevitable.

In the direction of practice also we may look forward with equal confidence, especially to the spread of geological facts and principles and to the extension of the applications of our science. The enormous increase in the utilisation of the mineral resources of our country which

is now going on, and the rapid opening up of the many mineral districts throughout the world-wide possessions of the Empire, bring day by day a larger array of students to our science from the side of economics.

And turning to the side of research, we are all of us aware that some of the grandest and most difficult problems of our science still await solution—problems as attractive, as stimulating, and as rich in promise as were any of those of the past. And if that past be a true index of the future, we may be well satisfied that there is no science which need outstrip ours in its rate of progress. When we call to mind that at the commencement of the great French Revolution, whose echoes have as yet hardly died away, our science was just struggling into existence, and that in the short time which has since elapsed it has placed itself abreast of the foremost, we have every incentive to push forward and to emulate those great pioneers in the science, in the mighty sum of whose conquests we rejoice and take a pardonable pride.

We have indeed abundant cause for pride, yet none for vainglory. No science, it is true, has made so swift an advance as Geology, but certainly to none has ever been afforded so magnificent an opportunity. The veil of ignorance and of traditional opinion which hid from the men of the Middle Ages the wonders which Geology has since revealed, was so dark and opaque that, until the close of the eighteenth century, no light could penetrate beyond. But so old and flimsy was it, that when once the strong hand of the geologist had torn it, it was soon rent through from top to bottom, and in the flood of light which entered, what wonder that discovery followed discovery in almost endless succession.

And we have deep cause for thankfulness in that these discoveries have been of benefit, not for our science alone, but for all its fellow-sciences: and more, that they have been from the first of supreme importance to man himself, his industries and his progress; and to the study of his history, his origin, and indeed of all that binds him and his fellow-creatures to the world on which he lives.

While, therefore, we move on confidently together in this dawn of a new era, blazing forward the straight and narrow trail of research marked out up to this point by our geological forefathers,—the "old trail, the lone trail, the trail that's always new"—let us ever remember that our science is not only the interpreter of Nature, but also the servant of Humanity.

BOTANICAL SURVEY IN YORKSHIRE.

A SUMMARY of recent papers[1] on this subject may not be without interest to the readers of the *Scottish Geographical Magazine*, where, in July and August 1900, appeared the first papers and maps which

[1] "Geographical Distribution of Vegetation in Yorkshire": Part I., Leeds and Halifax District, with Map. By William G. Smith and C. E. Moss. Part II., Harrogate and Skipton District, with Map. By W. G. Smith and W. M. Rankin.—*Geographical Journal*, vols. xxi. and xxii., 1903.

illustrated this method as adapted for Britain. While the work was proceeding in Scotland, observations were begun in Yorkshire, chiefly to give the author of the Scottish Botanical Survey an opportunity of comparing his results with those on another area. The comparison was never made, but the recognition accorded to the earlier essays warranted the continuation of the work so far as lay in our power, and Yorkshire was nearest at hand.[1] Other workers have also followed the stimulus given by the earlier papers, and surveys of vegetation on the lines laid down in these pages three years ago are in progress, to our knowledge, in many parts of Britain.

The two maps of Yorkshire now published cover about 1700 square miles, about one-fourth of the county, each sheet including approximately the same area as the Scottish maps, Edinburgh and Northern Perthshire. The southern map includes Leeds, Bradford, Halifax, and Huddersfield; while Harrogate, Ripon, and Skipton come within the northern sheet. The eastern boundary traverses the Plain of York within a few miles of that part of the East Coast Railway route which lies between Thirsk and Doncaster. The western limit is thirty-six miles to the west, on the Lancashire slopes of the Pennines. A considerable part of the area is traversed by the Midland main line (Carlisle to Derby and London) from near Hellifield, and through Leeds and Normanton to near Swinton. The orographical features will be seen if reference is made to Messrs. Bartholomew's series of two-inch-to-mile maps—Harrogate and Sheffield Districts. The highest elevations lie in the western part: Great Whernside (2310 feet) being in the north-west, and Holme Moss (1909 feet) near the south-west corner. Between the two summits there stretches an irregular moorland plateau, almost all above 1000 feet, except where cut by the valleys of the Calder and Aire. From the western uplands, the area declines gradually to the east, and is intersected by the valleys of the Calder, Aire, Wharfe, and Nidd, which flow south-east to join the Ouse in the Plain of York at about 50 feet above the sea. The area thus shows the vegetation of the watershed and the broad eastern slopes of that part of England included in the West Riding of Yorkshire. The underlying rocks belong almost entirely to the Carboniferous system: Millstone Grit in the uplands, except in the north-west, where a large area of Mountain Limestone is exposed, while the Coal Measures are the surface rocks east and south of Huddersfield, Bradford, and Leeds. A narrow tract of Permian Limestone runs from north-west to south-east near the eastern limit of the maps, but most of the eastern part has extensive glacial deposits of varied character.

The vegetation of the lowlands is not unlike Midlothian, but the uplands, although rarely exceeding an altitude of 2000 feet, frequently suggest a highland vegetation like that of Perthshire. There are, however, several differences, so that the survey of this part, while confirming many of the Scottish results, has added to the knowledge of vegetation,

[1] A continuation of the Botanical Survey of Scotland, dealing with Forfar and Fife, will probably appear in this *Magazine* during the current year.

and suggests new features for observation by workers in other parts of Britain. It is chiefly these newer features that are dealt with here.

The Moorland.—The moorland or uncultivated land on the Scottish maps is almost entirely heather moor, or grassy hill pasture. The existence of a third type is indicated as "peat bogs, usually with Calluna and Eriophorum predominant"; its occurrence is, however, local. On the Yorkshire moorland, the vegetation which occupies the greater area is one which, from its dominant plant, we have named the Cotton-grass or Eriophorum moss. In character this bears some resemblance to the peat bog vegetation of the Scottish maps. The Cotton-grass association occupies many square miles of the peat bogs on the summit plateau of the Pennines; it is co-extensive with the numerous mosses indicated on the Ordnance Survey maps. The dominant plant covers the ground so exclusively that few associates occur. Crowberry (*Empetrum*) and Blaeberry (*Vaccinium Myrtillus*) are not uncommon; Heather (*Calluna*) is, as a rule, sparingly distributed, and the Dewberry (*Rubus Chamæmorus*) is locally abundant. Peat varying from five to thirty feet in thickness forms the universal soil, wet throughout the greater part of the year; sometimes almost impassable, but very dry in long droughts like the summer of 1901. The mean annual rainfall of the mosses within our area is never less than 40 to 45 inches. My brother's field-maps of Rannoch Moor (unpublished) show that immediately to the west of the Northern Perthshire map, an extensive tract of peat-mosses begins. This is one of the most extensive associations throughout the West of Scotland, and here too it is correlated with a high rainfall and other conditions favourable to the formation of deep peat. The cotton-grass moss is therefore a distinctive feature of the vegetation of Western Britain.

The heather moor is noteworthy by its very limited extent in our southern district, but in the northern area it is well developed from the Wharfe northwards, and here one finds grouse moors as extensive as those of Perthshire and Forfarshire. The occurrence of the heather moor in mass is correlated with a lower annual rainfall (32 to 42 inches), less depth of peat, and a better drainage than exists in the cotton grass area.

The grassy moorland of Yorkshire falls under two divisions, the grass heath and the natural pasture. The former consists of grasses, with more or less admixture of associates of the heather moor. The latter is the hill pasture of the dales of the Mountain Limestone, distinguished by many associates peculiarly its own, and by the absence of heath plants. The grass heath is co-extensive with the Millstone Grit, and is limited to the slopes of the moor edge, where it forms a fringe round the moorland. It never attains to the extent found on the Pentlands and Moorfoots of the Edinburgh district map, which are typical grass heaths, as is shown by the frequent occurrence of the combined colours for hill pasture and heather.

The natural pasture lies almost entirely in North-west Yorkshire (the old shire of Craven), where the slopes of the dales consist of limestone from the bottoms up to 1500 feet, and in places even higher. The

landscape as a whole is entirely different from any part of Scotland we know. A passing glimpse of the characteristic scenery may be had on the Midland route (Carlisle to Leeds), between Hawes Junction and Hellifield, but a sojourn at Settle, or in the upper parts of Wharfedale (*e.g.* Grassington or Kettlewell), Airedale (*e.g.* Malham), or Wensleydale, would amply repay the Scottish naturalist. Like the Cheviots, Craven is a country of sheep-walks. The pasturage extends for many miles, but its uniformity is broken by long parallel series of scars extending far up the dales, and the ascent from any of the streams consists in an alternate traversing of hill pasture slopes, and steep rocky scars with loose screes at their base. Here and there the hillsides are deeply excavated by gills or stream courses, girt with rocky scars, which in some cases rise almost sheer for two or three hundred feet. The limestone scars are apparently bare rocks, but a closer examination of the many nooks and crannies reveals a flora as novel to the Scottish botanist as a first visit to Ben Lawers or Caenlochan. The scar screes are generally occupied by a copse or thicket of hazel and other shrubs interspersed with ash-trees. Here in early summer may be found Lily-of-the-valley, Solomon's seal, Baneberry (*Actæa*), and other plants unfamiliar to the Scottish botanist. In the original papers, representative lists of plants of the various limestone and other associations are given. A feature of the higher limestone pastures is the occurrence of "limestone pavements." These are scar tops or summit ridges eroded into what at first sight looks like a causeway, but, examined closer, will be found to be weathered out into a maze of deep crevices moist and shady, where plants from the lower woods find, at elevations of 1000 feet and over, conditions favourable for their growth. Ascending towards the higher summits of the moorland, one reaches the top of the Mountain Limestone and passes on to the Millstone Grit, which caps almost all the higher ridges and summits of North-west Yorkshire. A change in the vegetation follows at once, and peat bog, with cotton-grass and heather moor, presents a marked contrast to the limestone pastures, scars, and gills.

The summits of the Yorkshire hills lack the characteristic vegetation of the Scottish Highlands. Throughout the greater part of our survey, the blaeberry becomes dominant wherever an exposed peak or ridge stands out above the cotton-grass plateau. It is interesting to find that here, as on so many peaks of Northern Perthshire, the blaeberry shows itself more resistant than either the heather or the cotton-grass, and becomes the dominant element on the rocky, storm-swept, and exposed summits. On Great Whernside and other summits of North-west Yorkshire, the place of the blaeberry vegetation is taken by a grassy, sub-alpine vegetation, which reminds one of summits in Breadalbane and Forfarshire.

Woodland.—The West Riding includes about 67,000 acres of woodland, which compared with the total area gives a proportion rather less than that in Midlothian. The woods are confined to the lowlands and valleys, and they are numerous enough to give the landscape a well-wooded character. The woods in which oak is the dominant tree far outnumber any other kind, and give to the lowland scenery a distinct

character not often seen in Scotland. When the oak woods were examined, it was found advisable to distinguish the lowland oak wood from an upland form of oak wood. The former is characteristic of the eastern lowlands, and most so where the Coal Measures are the surface rocks. The upland oak wood occurs on dry rocky slopes of the Millstone Grit valleys, from 500 feet up to about 1000 feet. The greatest variety of trees occurs in the lowland zone, whereas the upland oak wood consists almost entirely of oak and birch. The upland oak wood is usually dry and rocky, and deficient in humus: the lowland oak wood is damp, shaly, and richer in humus. The shade cast by the trees is much greater in the latter than in the former. Hence the flora of the latter is much richer in species, especially of the bulbous and early flowering kinds; while the flora of the upland oak wood contains a high proportion of late-flowering, moorland xerophytes, which are practically absent from the lowland oak wood. The distinction between the two zones of oak wood is made evident by comparative lists of species in the original papers. The highest zone of tree-growth in the Millstone Grit area is a thicket in which the birch is the important element. The birch thicket is rather sparingly developed at present, but the occurrence of birch stems in the peat is not uncommon up to an altitude of 1500 feet and over, and indicates that the birch extended much higher on the moorland in former times. In the valleys of Perthshire and Forfarshire birch thicket is still an extensive and characteristic form of woodland vegetation, and its occurrence in Yorkshire confirms my brother's recognition of it. On the Mountain Limestone of North-west Yorkshire the highest zone of woodland is found in the hazel copse of the limestone scars, an association in which birch is not conspicuous.

The lowland woods of the Mountain and Permian limestones are distinguished by a marked falling-off in the dominance of oak, and a distinct increase in ash and beech. The beech is an important tree on the Permian tract, and its abundance brings about an increase in the shade-plants, and a decrease in the shrubby underwood and herbaceous plants of the less-shaded oak wood. The beech is said to be native in this part of Yorkshire, and the assumption appears to be supported by its luxuriant growth and large numbers both at present and in the past. Although the beech is not uncommon in the lowland oak wood, we regard it as introduced by planting.

Woods of Scots pine and other coniferous trees are well represented near the main mass of heather moor in our northern map. There is, so far as we can ascertain, no evidence, however, that the Scots pine is indigenous on the higher moors of this part of Yorkshire, and the existing woods seem to have been planted at no very remote date. The case is different in Scotland, where Scots pine is indigenous at considerable altitudes, as is shown by the occurrence of stems in peat, and from old records. The Scots pine is regarded by Yorkshire botanists to be indigenous on the lowland moors east of our present maps.

The Farmland.—The lower wheat zone and the upper "no wheat" zone distinguished in Scotland may also be recognised in Yorkshire. The wheat zone includes all the farmland of the lowlands, and rises to

an altitude of 600 to 700 feet, except in the narrow valleys. The drier and warmer summer of the Plain of York is indicated by the larger proportion of wheat cultivated, and the still larger proportion of mangolds, as compared with Midlothian or any other county in Scotland. The upper zone of cultivation without wheat is present in Yorkshire, but there is evidence that wheat may be more frequently cultivated at higher altitudes than in Scotland. The upland farms are almost all under grass, and present a decided contrast to those of Scotland, where there is usually a considerable area of oats and turnips.

The distribution of the vegetation in the part of Yorkshire examined has already received attention. The work of Mr. J. G. Baker on the geography and plant-distribution of North Yorkshire has not been so fully recognised as might be, and in view of recent developments in the direction of botanical survey, his *Studies on North Yorkshire* are worthy of attention. Mr. Baker and Mr. F. A. Lees (*Flora of West Yorkshire*) have, in following up the methods and suggestions of H. C. Watson and Jules Thurmann, prepared the way for a more systematic survey of Yorkshire. It is satisfactory to us to see that Mr. Baker has appreciated our work in a recent review.

GRAND TRUNK PACIFIC RAILWAY EXTENSION.

By Alexander Begg, Author of the *History of British Columbia.*

After several lengthy and heated discussions before the railway committee of the House of Commons, Ottawa, the preliminaries, parliamentary and financial, have been satisfactorily arranged by the promoters of the Grand Trunk Pacific Extension Company, so as to warrant them in commencing details of the extension and construction of their already magnificent system, and to enable them to proceed without much further loss of time with the construction of the line to the Pacific coast.

It was explained by Mr. Leighton M'Carthy, who had charge of the bill before the railway committee at Ottawa, that to open up the immense and valuable tracts of land through which the new line is to run, additional through lines would require to be constructed between the Pacific coast and Quebec, to join, at the latter-named city, the Intercolonial Railway, and form a continuous railway line entirely through Canadian territory, to Halifax, or such other port on the Atlantic coast as may be selected.

A slight change from the route at first talked of is likely to be made between Quebec and North Bay. That change is intended to be made by running the line about due north for about two hundred miles to Lake Abittibi, and joining the main line running west at or near the lake just mentioned. This prospective change would open a very large and important portion of the Province of Quebec, and, proceeding westerly, might be arranged to utilise a part of the Ontario government railway to be constructed between North Bay and James Bay.

Sir Rivers-Wilson, President of the Grand Trunk Company, in the railway committee room stated that he, having been for several years intimately connected with railway affairs in Canada, would see to it that there would be no danger of the interests of the Dominion being neglected, either in Atlantic ports or otherwise. Those announcements and explanations, together with the information that the construction of the new lines would be commenced simultaneously at different points, were well received as indicating that no time should be wasted to bring the extension to a speedy completion.

Considerable discussion took place relative to the selection of winter ocean ports on the Atlantic coast. As members representing maritime constituencies argued warmly on the subject, further consideration of the bill was postponed, so that the matter could be more fully discussed, from the 13th of May until the 27th *idem.*

Leading railway men have been asked as to their opinion of the probable success of the Grand Trunk Pacific Railway Extension. The reply of Sir William Vaultorne, lately President of the Canadian Pacific Railway, will be of some interest. He said: "The direct line from Quebec to the Pacific coast as laid down on the map would not injure the Canadian Pacific in the least degree—on the contrary, it would benefit the Canadian Pacific in many ways. The position of the Canadian Pacific Railway is absolutely unassailable. For that reason it is our policy not to oppose anything. . . . When the Northern Pacific road was built, everybody thought it was away up north beyond everywhere. Then the Great Northern was built, and people promptly forgot to think of the Northern Pacific as 'far north.' Then came the Canadian Pacific, and that seemed to run through the Arctic regions! We would hail with delight a parallel road from 'Atlantic to Pacific' to help us to develop the country. There is enough of it up there for us all."

Sir Sandford Fleming, the most celebrated railway engineer in Canada, perhaps in America, who has just completed the project of the Pacific telegraph cable from Canada to Australia, and who has an intimate knowledge of the whole country proposed to be traversed by the new line, was interviewed by a Montreal *Star* reporter when it was announced that the Grand Trunk was to be extended to the Pacific coast. His opinion is as follows:—

"I am inclined to think Mr. Blair (the Minister of Railways and Canals for Canada) is on the right track in proposing to extend the Intercolonial Railway to the Pacific. It seems to me, however, that it would be a mistake to try to form a new trans-Continental line in a haphazard way by connecting various fragments of railway which have been located without any general plan. This effect would be to lengthen the whole line and unduly lower its engineering character, and almost certainly give it features which would for ever be regarded as blemishes in a great trans-Continental line. To realise Mr. Blair's conception of a new national railway, it should, in my judgment, begin at the Quebec bridge now building, where it would form a direct connection with the Intercolonial, and it should extend from Quebec by the most direct route to Port Simpson on the Pacific. From what I know of the

general character of the intervening distance, I believe a line with splendid engineering features could, with ordinary care, be secured. It would pass away to the north of the rugged shore of Lakes Huron, Superior, Nipigon, and Winnipeg, through a vast region reported generally of alluvial soil, with an abundance of wood and water.

"*First.* The Quebec bridge is in progress. That structure I have always favoured, but it would have been a bold man to have proposed such a work a quarter of a century ago. The Quebec bridge will give the needed connection with the Intercolonial, as well as with the Grand Trunk Railway, and along with a junction with these railways access and egress to and from Atlantic points at all seasons.

"*Second.* The greater part of the vast region through which the new line might pass between Quebec and Port Simpson is woodland, and we have to-day a new value to the timber, which was undreamed of twenty-five years ago. The territory to be traversed is the natural home of pulp wood, and in this vegetable substance the unoccupied regions of Quebec and Ontario have an inexhaustible crop ready for harvesting—a crop of perennial character, which, in extent, I venture to say, is unsurpassed in the North American Continent, perhaps in the whole world.

"I have already expressed my doubts as to the wisdom or expediency of proceeding in a haphazard way to establish a new trans-Continental railway. - I regard the shortest line obtainable between the tide-waters of the two oceans as quite long enough. For that and other cogent reasons I would advocate the most favourable route which can be had between the Port of Quebec and Port Simpson for a new Dominion Grand Trunk line, and at the same time keep in view the establishment of railway service with all desirable points by branches judiciously laid out. By having regard to these leading principles, great advantage would, in my judgment, result. It seems to me that there is ample room for the new railway. It would in no way interfere with any other line, and it may be regarded as a natural development of the railway system of Canada. I am satisfied that it is possible to establish a splendid national railway on the route proposed, with the best ocean ports as its termini. With a Rocky Mountain passage very much lower than that of any railway yet constructed across the North American Continent, and with general engineering features even more favourable than those obtained on the Intercolonial Railway, such a line would give breadth to Canada and admit of settlements and profitable industries where such are not now possible. In the far North-West it would open up for ranching the rich plains of the Peace River and Northern British Columbia, and render the most distant gold-fields more easily accessible at all seasons.

"When the day arrives to open the railway as a through route it will be found to possess advantages, in respect to distances, as compared with the route *viâ* San Francisco and New York. From Yokohama to Liverpool the passage across the Pacific ocean would be 605, and across the Atlantic 195 nautical miles less, while the land distance would be 502 statute miles less; the total saving on the whole distance would be about 1423 statute miles.

"Regarded simply from a Canadian standpoint, I cannot conceive any public undertaking that would better meet the wants of the New Dominion, throughout its whole extent. I rejoice to know that it has so soon in Canadian history been brought up for serious consideration."

It was explained before the railway committee by the chief officers of the company that the main line will probably touch the city of Winnipeg. From that city the line will run in a north-westerly direction through the Saskatoon district to Battleford, whence a branch line will be built to Calgary; whilst the main line will be continued to Edmonton. From Edmonton "the Grand Trunk Pacific Extension" will probably have two lines built to the coast—one through the Yellow Head Pass to Bute Inlet, the other through Peace River Pass to Port Simpson. An extension will eventually be made north from Port Simpson to run through the Cassiar district, *viâ* Atlin and on to Dawson. This will be an important branch, as it will be the outlet of the great gold-producing Yukon, and the first connecting railway to reach the Pacific Ocean from Dawson to Burroughs Bay — thence to Fort Simpson and Dixon Entrance to the wide Pacific, for China, Japan, or Russia. Fort Simpson is a most important strategical point, and cannot well be overestimated, on account of its proximity to the southern point of Prince of Wales Island, which now belongs to the United States, by session from Russia, under the Anglo-Russian treaty of 1825.

THE TERMINOLOGY AND NOMENCLATURE OF THE FORMS OF SUB-OCEANIC RELIEF.

THE first meeting of a Committee of the Sixth International Geographical Congress appointed at Berlin in 1899 to consider a scheme of international nomenclature for the forms of sub-oceanic relief was held in the Hotel Nassau, Wiesbaden, on April 15 and 16, 1903.

There were present, H.S.H. The Prince of Monaco; Prof. O. Krümmel, Kiel; Prof. A. Supan, Gotha; Prof. O. Pettersson, Stockholm; Prof. Thoulet, Nancy; Dr. H. R. Mill, London. M. Sauerwein, aide-de-camp to the Prince of Monaco, acted as secretary of the Committee. Sir John Murray and Dr. Nansen, members of the Committee, were unable to be present.

The Committee was charged with two duties—

(1) To draw up an authentic map of the oceans, embodying the results of all existing deep-sea soundings, for presentation to the Seventh International Geographical Congress at Washington in 1904.

(2) To consider a system of international terminology and nomenclature for the larger features of sub-oceanic relief.

(1) Prof. Thoulet brought forward a scheme for constructing a chart of the oceans on the equatorial scale of 1 : 10,000,000 (approximately 160 miles to an inch), two different projections being adopted. From 72° S. to 72° N. the chart would be on Mercator's projection, and

would comprise twenty-four sheets. From 72° to the poles the gnomonic projection would be employed, each polar area including four sheets, so that the whole map would consist of thirty-two sheets of a convenient size. All soundings of greater depth than 1000 metres would be entered upon the chart, and isobathic lines drawn so far as the data warranted. The unexplored part of the oceans would be left without isobathic lines, and it was proposed to issue the map uncoloured. It was understood that the Prince of Monaco would be responsible for the production of this map, should the Washington Congress approve of the scheme.

After a prolonged discussion of the scale and the projections, the Committee unanimously resolved to recommend the Congress to adopt Prof. Thoulet's scheme in its entirety. It also recommended that the data of the new map should be published on an equivalent area projection on a smaller scale, suitable for the use of oceanographers in plotting various distributions for the purpose of measuring areas. It was suggested that this might be undertaken by private enterprise.

(2) As regards terminology, it was resolved to ask the German members of the Committee to draw up definitions of the terms used for the more important forms of sub-oceanic relief, and to communicate them to the other members for consideration and for consultation with other geographers. When the definitions are adopted, the Committee should decide as to exact equivalents of the terms in French and English.

It was resolved to recommend that for the larger features names descriptive of their geographical positions should be exclusively adopted, as has been done in Prof. Supan's bathymetrical chart published in 1899. For smaller features and for special points the names of persons or of ships might be freely used.

The following is the terminology of the most important forms of sub-oceanic relief, proposed by Profs. Supan and Krümmel.

I. The Greater Forms.

1. The **Shelf** (*Schelf*) is the only form of the continental border which is of independent importance. It is the portion of the continental border which extends seaward from tide-marks, sinking very gradually, as a rule, to the depth of about 100 fathoms or 200 metres, and then suddenly falling steeply to a great depth. Examples: the British, Sunda, and Newfoundland shelves.

2. The **Depression** (*Vertiefung*) is enclosed on all sides by elevations of the sea-bed.

(*a*) The *Basin* (*Becken*) is a depression of approximately round form, in which the horizontal diameters are about equal.

(*b*) The *Trough* (*Mulde*), an elongated and wide depression, with gently sloping borders. A trough may be divided by transverse elevations into basins, as, for example, in the Atlantic.

(*c*) The *Trench* (*Graben*) is also an elongated depression, but proportionally of small breadth and with steeply sloping borders, one of which (the continental) rises higher than the other (the oceanic). Trenches are the ends of unsymmetrical basins, and

lie beside the continental border or island chains. The Cayman trench alone runs between islands, but in its case also the borders are of unequal height. Strictly speaking, the trench is only a secondary form of the great depressions of the ocean floor, but on account of its considerable length, its depth, and its genetic importance, it may well be reckoned as one of the principal forms.

The extension of a trough or basin which penetrates the land or a submarine elevation, either with a uniform or a gradually diminishing depth, or which is bounded on the one side by land and on the other by a submarine elevation, may be—

(*a*) An *Embayment* (*Bucht*), if wide, and of a rounded or triangular form, as, for example, the East Australian embayment.

(*b*) A *Gully* (*Rinne*), if long and narrow (*e.g.* the Färoe gully, the Norwegian gully).

3. The **Elevation** (*Erhebung*) is either entirely surrounded by depressions or is a prolongation of the continental border.

(*a*) The *Rise* (*Schwelle*) is an elevation which rises gradually with an angle of only a few minutes of arc, irrespective of whether it is wide or narrow, or of its vertical development. On account of its flatness the rise apparently plays only a subordinate part, but rises carry the chief features of sub-oceanic relief, so that if the ocean floor was changed into dry land they would act as the main watersheds.

(*b*) The *Ridge* (*Rücken*) is a relatively narrow elevation which is prominent on account of the steep angle at which it rises. It is thus narrower than an extended rise, the distinction being clear where a rise assumes in some parts the character of a ridge, as, for example, the Atlantic equatorial ridge. The category of ridges includes both greater and minor forms.

(*c*) The *Plateau* (*Plateau*) is a steep elevation of large extent in which the length and breadth do not greatly differ. It may rise from the depressions of the ocean floor, or from a rise (*e.g.* the Azores Plateau).

4. A *Deep* (*Tief*) is the deepest part of a depression (*e.g.* the Nero Deep). A *Height* (*Höh*) is similarly the highest part of a rise, ridge, or plateau, if it does not belong to the base of an island or is classed as an independent minor form (*e.g.* the Valdivia Height on the Walfisch Ridge).

II. Minor Forms which are of smaller extent, but, on account of steeper slopes, clearly distinguished from their surroundings, include—

1. **Elevations**:

(*a*) Elongated elevations usually of irregular surface: Ridges.

(*b*) Single elevations of submarine mountains, particularly—

(α) The *Dome* (*Kuppe*), an elevation of small area, but rising with a steep angle to a depth more than 200 metres from the surface.

(β) The *Bank* (*Bank*) rising to within 200 metres of the surface, but not so far as within 11 metres (*e.g.* the Porcupine Bank, or Princess Alice Bank).

(γ) The *Shoal* (*Grund*) and *Reef* (*Riff*), which come within 11 metres of the surface, and so are dangerous to shipping (*e.g.* Paracels Reef, Adler Shoal).

2. **Depressions:**

(*a*) The *Caldron* (*Kessel*), a more or less steep depression of relatively small extent (*e.g.* the Monaco Caldron on the Azores Plateau).

(*b*) The *Furrow* (*Furche*), a valley or channel-like hollow in the continental border, and more or less at right angles to it (*e.g.* the Indus Furrow, the Ganges Furrow).

The opinion of geographers as to the appropriateness of this terminology, or as to the best synonyms of the German terms, is asked for.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Scottish National Antarctic Expedition.

A subscription of £2 to the funds of this expedition has been received from Lord Lamington, K.C.M.G., and of £5 from Miss Jane Hay.

GEOGRAPHICAL NOTES.

EUROPE.

Proposed Forth and Clyde Ship Canal.—Messrs. D. and C. Stevenson, civil engineers, Edinburgh, have been engaged for some weeks surveying the valley between the estuary of the Forth and Loch Lomond for clients; and this firm has now been instructed to prepare plans for a canal to connect the Firth of Forth with the Firth of Clyde. The plans will be prepared forthwith, and it is expected they will be lodged in November for the purpose of securing Parliamentary powers for the scheme. The route the engineers state the proposed canal will take is from Alloa, on the eastern side, where it will pass to the north of the links of the Forth and to the northward of the town of Stirling. Passing along the valley of the Forth near Kippen, a deep cutting will take the canal into Loch Lomond, near Buchanan Castle. The navigation will then be on Loch Lomond to Tarbet, and another deep cutting will take the canal to Loch Long, which will be the outlet on the west. Loch Long is an arm of the sea providing a safe anchorage, and navigable by all classes of vessels. The actual distances of the canal are as follows:—From Alloa to Loch Lomond, 28 miles: Loch Lomond to Tarbet, 14 miles; and Tarbet to Arrochar, one and three quarter miles. Arrochar is at the head of Loch Long, and lies 15 miles from the Clyde. The actual cutting extends to $29\frac{3}{4}$ miles, and the chief engineering difficulties will be encountered near Loch Lomond, where a very deep cutting will be required, and again at the narrow neck between Loch Lomond and Loch Long. The surface of Loch Lomond is 22 feet above the mean sea-level, but the land on the strip between Loch Lomond and Loch Long rises to a *maximum* height of 130 feet above mean sea-level. The canal, if carried out, would shorten the passage by 529 miles between the Clyde and East Coast ports.—*Times.*

Rainfall and River Flow in the Thames Basin.—The Water Committee of the London County Council recently instructed their engineer to prepare a report on the shrinkage in the Thames and Lea, and the report is now available. Mr. Fitzmaurice, the engineer in question, finds that for the past twenty years there has been a decline over the Thames watershed of an annual average of nearly $2\frac{1}{2}$ inches below the mean rainfall of 28·50 inches as computed by the late Mr. Symons for the forty years 1850-89, this diminution having become accentuated during the past five years. In consequence the flow of the river as measured at Tedington Weir shows a decline of $239\frac{1}{2}$ million gallons per day as compared with the previous period. As the diminished rainfall of $2\frac{1}{2}$ inches equals 105 million gallons per day, after making an allowance for evaporation, and the diminution of the flow mentioned above shows a difference of $134\frac{1}{2}$ million gallons daily in excess of this, it would appear as if the condition of the river was becoming more acute, inasmuch as more rainfall would be required year by year to produce the long-period average rate of flow. In other words, the percentage of the total rainfall reaching the river is diminishing as well as the rainfall itself. Dr. Hugh Robert Mill, in commenting in *Nature* upon this report, expresses the opinion that the decline in the rainfall is not so serious as it appears to be from the report, and that in probably a short period of time the rainfall will again reach its former average, but at present we are in a period of relatively low rainfall.

Distribution of Population of Provence.—The census of 1901 shows some interesting facts regarding the distribution of the inhabitants of Provence, that is of the departments of Bouches-du-Rhône, Var, Alpes-Maritimes, Vaucluse, and Basses-Alpes. In the first place, the population shows a remarkable concentration in the littoral region. More than half the inhabitants live there in a district comprising only three-twentieths of the total area. In the second place, the population is grouped in Communes, whose effective population (from the military standpoint) is greater than that of the mean for France. It is suggested that the explanation of the first fact is the physical condition of the interior and the industrial resources offered by the littoral zone. The explanation of the second fact is more complex. One factor is doubtless racial—the natural hatred of the lively Provençal for isolation. Again, here as elsewhere, the population is attracted rather to industry than to agriculture. Thirdly, owing to the nature of the natural products of the region, a relatively dense population is required at certain centres, in order that the produce may be put upon the market as rapidly and as effectively as possible. In the interval between the census of 1896 and that of 1901, the growth in density of population of the littoral zone has been specially marked. Thus, in the interval between the two censuses, Bouches-du-Rhône has gained 60,527 inhabitants, Alpes-Maritimes 28,058, Var 17,071, while Vaucluse has only gained 336, and Basses-Alpes has lost 3121. The growth has been due not to an increase in the birth-rate over the death-rate, but to immigration, largely foreign immigration. In Alpes-Maritimes there has been an excess of births over deaths of 1860, but in the four other departments the deaths exceeded the births by 9563. A detailed examination of the distribution of the population renders even more striking its concentration in the littoral zone. In Bouches-du-Rhône, Var, and Alpes-Maritimes, where the littoral Communes have a superficial area which does not exceed 3694 square kilometres, the gain in population between 1896 and 1901 has been 96,137, while the interior, with an area six times as great, has only gained 7029. In 1896 the coast possessed 51·7 per cent. of the population; in 1901 this percentage had risen to 54·1. Further, in this region between 1896 and 1901 the kilometric density of the

population had risen from 224 to 250, while in the interior it has remained stationary at about 38. The increasing concentration of the population in the towns has been equally marked in the period under consideration. The Communes containing more than 5000 inhabitants have increased by 104,244. Marseilles has gained nearly 50,000 inhabitants. The Communes containing from 2000 to 5000 inhabitants have similarly grown by about 8500 units, while those of 1000 to 2000 have lost 9000 members.—*La Géographie.*

ASIA.

American Improvements in the Philippines.—Among the changes which have followed the American occupation of the Philippines, perhaps the most marked have been the general improvements in the sanitary condition of Manila, previously such as to invite all the devastating disorders of hot climates. The history of the campaign against plague especially is a triumph of modern preventive medicine. At the end of December 1899 plague was discovered in Manila. During 1900 there were 271 cases and 199 deaths, being a percentage of 73·4. In 1901 there were 471 cases with 432 deaths, being a rise in the death-rate to 91·7 per cent. In 1902, as a result of the measures adopted, there were only three cases, and these occurred exclusively in the early months of the year. Where the plague was already established, the methods adopted did not differ from those which have been established by universal experience, but in addition an energetic campaign against rats was begun in all parts of the city. Official ratcatchers were appointed, and bounties were also paid for all rats brought to the sanitary authorities. Each rat when handed in was marked with the exact locality where captured, and then sent to the bacteriological laboratory. In this way 60,000 rats were sent to the laboratory, and of these more than 40,000 were tested for plague bacilli. Of the latter, 242 were found to be infested with plague, and the houses from which they had been taken were subjected to as rigorous a process of inspection and disinfection as if a case of plague in man had occurred there. Where from their construction the buildings in which plague rats occurred were found incapable of adequate disinfection, their destruction was ordered. Owing to the ease with which the infected rats could be traced to their locality of origin, it was possible to determine beforehand the possible centres of disease, and thus take measures of precaution in time. It says much for the care exercised in the bacteriological department that in spite of very inadequate buildings, and the large number of infected rats handled by the staff, no case of plague occurred among its members.

In addition to the other measures adopted, inoculation with anti-plague serum was practised on a large scale, over 25,000 persons being subjected to the treatment. The ultimate result, as indicated above, was the total disappearance of plague both from Manila and the provinces. Unfortunately, however, this happy result was only obtained at a price, for the chief health inspector, Dr. Meacham, on whom the burden of the responsibility fell, broke down as soon as his work was completed, and died in April of last year. Further, although plague was eliminated, Asiatic cholera made its appearance in the islands, and could not be controlled in the provinces, where it claimed some 100,000 victims, while in spite of all precautions some thousands died in Manila.

Apart from sanitary work, which in many parts of Manila was sadly needed, great efforts are being made to provide healthy amusement for the townspeople by the formation of recreation grounds, parks, and the improvement of existing public gardens. Efforts are also being made to improve agriculture, and to introduce modern methods, in place of the very primitive ones now in use. In the gutta-

percha, tobacco, hemp, and sugar industries especially, it is estimated that at present about 50 per cent. of the product is lost owing to the wasteful methods employed. It seems probable also that considerable additions may be made to the plants at present cultivated in the islands. Much of the land is well adapted for growing cocoa-nuts, while the cacao and coffee plantations are capable of great improvements. Cattle-raising and dairy-farming can also be profitably carried on, the demand both for fresh milk and meat being at present very much greater than the supply.—*National Geographic Magazine.*

Russian Exploration of Tibet.—Some interesting details have come to hand in regard to an expedition to Central Asia and Tibet, undertaken by Captain Kozloff. Captain Kozloff left the village of Altais on July 26, 1899, accompanied by two assistants, MM. Kaznakoff and Ladygine, and an escort of sixteen soldiers, with the intention of making for the town of Kobelo. In order to facilitate the work of the exploration of the Russian and Mongolian Altai, and to carry this out more completely, the expedition was divided up into three parties, independent of one another, and in this way the central steppe of the Gobi desert and the country of Han-su and Tsaidam, regions hitherto absolutely unknown, were traversed. The expedition had a very cordial and hospitable reception everywhere from the inhabitants, and took numerous meteorological observations as well as a great many notes with regard to the flora and fauna of the country. After establishing a meteorological station in the Tsaidam, where the collections were left, the expedition started for the heights of Tibet. On arriving there the travellers were greatly surprised at the large variety of animals to be found there, especially the remarkable species of birds, Tibetan bears, yaks, antelopes, and an enormous number of extraordinary fish. Captain Kozloff's expedition was at first allowed to enter the territory of the Dalai-Lama, but it was stopped on reaching districts strictly reserved. It was consequently compelled to winter for five months in the Mekong Valley, where the travellers became acquainted with the customs of the Tibetans, learned their history, and studied their system of herb medicine. On resuming its journey, the expedition passed the place where the French explorer, M. Dutraul-de-Reins, was killed in a skirmish with Tibetans in an attempt to penetrate forcibly into the domains of the Dalai-Lama. Captain Kozloff gave the name of the explorer to the mountains near which he was killed. The expedition was shortly afterwards itself attacked by a band of three hundred marauding Tibetans, who ambuscaded the party, but were dispersed by a fusillade, with a loss of twenty-eight killed and eighteen wounded. The expedition did not hear of the Boxer outbreak until it had returned to Tsaidam, but luckily the rising did not have any disagreeable consequences for the party. The results attained by the expedition are considerable. It traversed and made a study of parts of Tibet which had never before been visited by Europeans, and made collections which will have an important bearing on the ethnography and the flora and fauna of the country, while it also obtained valuable meteorological data.

An Ethnographical Expedition to New Guinea.—The *British Medical Journal* states that an expedition is to start for New Guinea in August for the purpose partly of ethnological investigation, but also with the object of collecting data in regard to the distribution and etiology of cancer. The latter portion of the work has been officially recognised by the Cancer Commission. A grant has been made by the Royal Society towards the expenses of the expedition, and the Royal Geographical Society has undertaken to lend the greater part of the instruments for the geographical investigations which are to be carried out. The expedition, which has been organised in London by Major W. Cooke Daniels, will be unusually

well equipped, and a schooner with auxiliary steam power will serve as a movable base. There will also be a sea-going launch. Major Daniels, who has had much tropical experience, will devote himself mainly to ethnology and experimental psychology. Dr. C. G. Seligmann, until recently the superintendent of the clinical laboratory, St. Thomas's Hospital, is the representative of the Cancer Commission on the expedition, of which he is in general medical charge. With Dr. W. Mersh Strong, he will pay attention to pathological questions of a more general character. Dr. Strong will be responsible for the geographical and geological observations. The photographic work, which will include the use of the latest form of cinematograph for recording native dances and ceremonies, will be undertaken by Mr. A. H. Dunning.

AMERICA.

Diversion in the waters of Niagara.—Attention is directed by Mr. O. E. Dunlap to a remarkable diversion in the waters of Niagara which happened on March 22 (*Scientific American*, April 4). On the previous afternoon ice came down the upper river from Lake Erie in such quantities that immense masses lodged on the rocks above Goat Island and diverted the water from the American to the Canadian channel. Thus the river-bed above the American fall, between the mainland and Goat Island, was left practically dry, and numbers of people were able to walk from Green Island over reefs of rock to the head of Goat Island. Here and there gravelly deposits and loose blocks of limestone were to be seen, amid great patches of ice, and barely enough water fell over the limestone ledge to curtain the rocky cliffs below. It is recorded that a similar incident occurred on March 29, 1848.

Secondary Phenomena of West Indian Eruptions.—In the *Journal of Geology* (vol. xi. No. 2), Mr. George Caroll Curtis gives an exceedingly interesting account and explanation of the valley eruptions, which were such frequent and alarming concomitants of the great West Indian eruptions. These eruptions occurred in river beds and cañons, and on a smaller scale exhibited all the phenomena associated with the great outbursts from the craters of the summits of the volcanoes. In consequence, they were regarded by almost all scientific observers as due to the presence in the river beds of subsidiary craters, which acted as safety valves to the main craters. Mr. Curtis observed several hundreds of these so-called minor eruptions, some at close quarters, and has come to the conclusion that they are not due to lateral craters at all, but are secondary phenomena of the nature of geysers. He found that all the rivers rising in Mount Pelée and the Soufrière had their beds covered with a layer of volcanic ejecta, varying in depth from a few inches to one hundred feet or more. This layer of ash retained its high temperature beneath the cooled surface, but when, as normally happens, the beds of the streams were dry, there was no obvious external indication of this high temperature. But if percolating water found its way through the surface-cooled layer down to the heated layers below, then a volume of steam would be gradually generated, which, in course of time, would gain force enough to explode, and throw up the surface layers of ash in a mimic eruption. One result would be to produce an orifice or vent, which would greatly facilitate the entrance of renewed supplies of water in the intervals between the eruptions, and thus furnish the motive force for new explosions. The necessary water may be supplied in various ways. For instance, a sudden tropical downpour may flood the dry stream channel, and as observed on one occasion by the author, be followed in about an hour by the characteristic eruptions. In other cases the instigating cause may be an

eruption flood from the primary crater, which suddenly fills the river valleys. Again, landslides may dam back streams, and result in the formation of a temporary lake, whose waters may by percolation reach a hot ash-bed, lying beneath a surface deposit. In all cases the result is to produce a mimic eruption, which, in all its main features, including the formation of a cone, closely resembles a true summit eruption. From such an eruption, however, these ash-crater explosions may be distinguished by the locality in which they occur, always within streams or their deltas, by the fact that the wall of the crater is composed entirely of fragmental material with no trace of old bedrock, that eruptions only occur after an accumulation of water, and that the ejecta have a relatively low temperature. Finally, it should be noted that the ash-geyser cones never reach any considerable size, nothing to be compared to a true lateral crater.

The Slavic Immigrant in America.—In the *Popular Science Monthly* for May, Dr. Allan M'Laughlin of the U.S.A. Public Health Department gives some interesting statistics in reference to the Slavs entering the States. Before 1868 very few Slavs entered America, but since that date their numbers have been yearly increasing until they now represent one-fourth of the total number of immigrants. To the grand total of nearly 155,000 Slavs who entered the States during the year ending in June 1902, the Poles contributed nearly 70,000, while the Slovaks contributed approximately 37,000, and the Croats about 30,000. Of the male Polish immigrants, five-sixths are unskilled labourers, and in consequence 64 per cent. of them find their way to the states of Pennsylvania, New York, and Illinois, where the demand for this kind of labour is great. They find employment especially in mines, mills, manufacturing works, and great works of construction. The Slovaks are similarly chiefly unskilled labourers, and 54 per cent. of them settle in the state of Pennsylvania. Of the Croats seven-eighths are unskilled, and owing to their good physique form a valuable addition to the community. Of the remaining Slavs, the Czechs, which furnished for the year under consideration about 5600 souls, differ from their allies in that more than 50 per cent. of the immigrants are skilled labourers or mechanics. This fact is illustrated in a very interesting way in their distribution in their new country, for they spread from New York to Nebraska and Texas, the reason being that their skill enables them to find employment over a wider area. Only about 25 per cent. remain in the State of New York. All the Slavonic races possess a strong physique, are willing to work, and have a high moral standard, family ties being very strong among them.

Trigonometric Survey of Brazil.—The Brazilian Government has provided for the mapping of its territory on a scientific basis. Last year the Congress appropriated the necessary funds for commencing the work, and a commission, of which Colonel Francisco de Abreu Lima is President, was to leave Rio early in May for the state of Rio Grande do Sul to make a reconnaissance of the first zone to be triangulated.

The scheme, as far as at present outlined, includes the measurement of bases at Porto Alegre and Uruguayana and the connection of these two cities by triangulation. This will give an arc of about six and one quarter degrees of longitude in about latitude 30° South.

The Superintendent of the U.S. Coast and the Geodetic Survey has been requested by the commission to supervise the preparation of the necessary tapes and accessories for the measurement of the bases.

Expedition to Bolivia.—Prof. Steinmann, of Freiburg, and two of his fellow-geologists of the same university, have arranged an expedition to the Central

Andes of Bolivia. The party will start in August for Buenos Ayres, whence the route to be taken is *viâ* Jujuy, Tarija, Sucre, to Cochabamba. After a prolonged stay in the mountains the explorers will probably work their way to Antofagasta *viâ* La Paz. The outfit is of the most modern description, and Dr. Hook, who is a member of the expedition, is one of the most capable German mountaineers.

AUSTRALASIA.

Geology of Hawaiian Islands.—In *Science* for May 8 is given a brief abstract of a paper on this subject by Mr. Whitman Cross. Mr. Cross points out the remarkable uniformity of composition of the basaltic lavas which have continued to flow out from the volcano of Kilauea since some unknown date in the Tertiary until the present time. At one point in the island trachytic rocks have been recently discovered, but this exception only serves to emphasise the rule of uniformity, so different from the progressive changes in composition to be seen in the lavas of most other volcanic centres. The recent eruptive activity of Kilauea, beginning in June 1902, was confined to the pit crater of Halemaumau. This pit is from 1200 to 1500 feet in diameter, and was about 1000 feet deep before the lava appeared in its bottom last June. Up till the end of 1902 the sum total of many small gushes of lava was enough to fill up the pit to a distance between 700 and 800 feet below the crater rim.

The islands generally offer exceptional opportunities for the study of physiographic processes, for they exhibit all stages in the sculpturing and degradation of volcanic mountains from the unmodified dome of Mauna Loa to the islet, hardly more than a reef, which represents the remnant of a former basaltic volcano.

POLAR.

National Antarctic Expedition.—In the *Geographical Journal* for July there appears a report by Commander Scott, addressed to the Presidents of the Royal and Royal Geographical Societies. The greater part of its contents has already appeared in our pages, but the voyage to the winter quarters of the ship is described with more detail than has been hitherto available, as also the various sledge journeys. Scurvy was first definitely recognised as a result of an arduous sledge journey undertaken by a party under the charge of Mr. Armitage, but the outbreak proved slight, and all those affected rapidly recovered. No definite conclusion was arrived at in regard to the cause of the disease, except that previous to its appearance the supply of fresh seal meat had run short. It was found that a full ration of seal meat proved most effective in combating the disease, and Captain Scott, when the letters left, declared that he had no anxiety in regard to the coming winter, believing that an ample supply of seal meat would be available. The party had also used skua gulls for food, and found them good eating. As regards the food for the dogs, it was found that the animals rapidly deteriorated on a diet of Norwegian stockfish, which has been stated to be the most suitable food for the animals as proved by experiments in Greenland. The only explanation which Captain Scott had to offer of this discrepancy is that the fish must have been injuriously affected during the journey through the tropics. Captain Scott's report includes reports of the sledge trips made by Lieutenant Barne and Dr. Koettlitz.

The Ziegler North Polar Expedition.—The vessel *America* with this expedition on board sailed from Trondhjem on June 23, under the command of Mr. Anthony

Fiala. Mr. Peters of the U.S. Geological Survey is second in command, and is to have entire charge of the scientific observations. The expedition is to advance as far north as the ship can travel, and then to winter in Franz Josef Land. Next spring a sledging expedition with the Pole as its objective will be undertaken, the vessel carrying thirty Siberian ponies as well as two hundred dogs. The scientific observations are to be chiefly confined to such as can be carried out at the winter station. A series of pendulum observations for the determination of gravity are to be undertaken; systematic tidal observations will also be carried out at the base camp, and preparations have also been made for the carrying out of a series of magnetic and meteorological observations, while soundings will be taken on the northern journey of the vessel, and if possible on the sledge journey also. In June 1904 an auxiliary vessel will sail to Franz Josef Land to carry additional supplies, and to escort the expedition home. A considerable number of the members of the expedition have had previous experience of ice-navigation or of work in the Polar area.

The German Antarctic Expedition.—The following is a brief abstract of Professor Drygalski's report on this expedition. The report begins with the start from Kerguelen on January 31, 1902. The ship reached the Heard Islands on February 3, from which point the regular South Polar voyage began. The *Gauss* proceeded in a south-easterly direction towards a land, the existence of which was reported by the Wilkes expedition, but placed in doubt by the *Challenger* expedition. After a rough voyage, the first drift ice was reached on February 13 at 61·58° S. lat., 95·8° W. long. On the 18th to the 22nd of February 1902 an effort was made to make a good push southward, but this was stopped, the *Gauss* being fast caught in the ice, and thus compelled to lie up for the winter. Professor Drygalski christened the bay in which the *Gauss* lay Posadowski Bay, and the ice-free volcanic peak, 1200 feet high, on the south side of the *Gauss*, was named the Gaussberg.

On February 8, 1903, the *Gauss* was set free by a strong easterly wind, and went along the northern edge of the western ice, which she finally lost sight of on February 19, 1903, in 65·32° S. lat. and 87·40° E. long. She then drew near to the ice again, and was held fast from March 6 to March 14 for a second time. She again managed to reach the open sea, in which she advanced as far as 64·51° S. lat., and 8·14° E. long. Travelling became difficult owing to the ever-growing length of the nights. On April 8, 1903, it was determined to turn back northward at 64·58° S. lat. and 79·33° E. long. On April 8 Kerguelen was passed, and on June 9 Simons Town was reached, all well.

Danish Expedition to Greenland.—Reuter's Agency has received the following particulars of the operations of the Danish literary expedition, which consists of M. Mylius-Erichsen, the author; Count Herald Moltke, the painter; Dr. Bertelsen, and a student, M. Knud Ramassen. Last summer they made a voyage in boats along the west coast of Greenland from the colony of Godthaab to the colony of Jacobshavn, where the expedition wintered. In February the expedition started on sledges drawn by dogs for Upernivik (lat. 73 deg. north), the most northerly Danish settlement in West Greenland, which was reached in March. By March 24 the preparations for leaving Upernivik were complete, and some members of the expedition were about to proceed in a northerly direction along the coast with the intention of reaching Cape York by way of Melville Bay, the shores of which are quite uninhabited, and which have never yet been explored. The object of the journey was to study the tribes of Esquimaux. Dr. Bertelsen

was starting southwards through the Danish districts of Umnak, Godthavn, and Egedesminde, in order to collect material for his book on the diseases of Greenland. He purposed meeting the Cape York expedition on its way home in South Greenland this summer. Several months' provisions for six men, and one month's food for six teams of dogs (ten or twelve dogs to a team) were deposited last summer at the most northern point of the Danish coast. All the members of the expedition were well when the letters left.

Swedish Antarctic Relief Expeditions.—Commander Irizar, the Argentine naval officer who will command the relief expedition which is being sent out by the Argentine Government in search of Dr. Otto Nordenskjöld's South Polar expedition, is expected to leave for Buenos Ayres about the beginning of August. The relief vessel—the *Uruguay*—is an Argentine gunboat sheathed with wood, and has been selected as being specially adapted for the work in hand. She will be strengthened so as to withstand ice pressure. The complete plans of the relief expedition are not yet fully known. The ship will be in charge of Argentine officers and crew, and will be provisioned for two years. It is not, however, probable that she will winter in the Antarctic. Commander Irizar is leaving for Norway in a few days to buy furs and other stores. He was formerly in command of the Argentine warship *Patria*, in which ship Sub-Lieutenant Soveral, the Argentine officer now with Dr. Nordenskjöld, was serving. It will be noticed that this relief expedition is in addition to the one which is being sent out under the auspices of the Swedish Government. (*Cf.* this Magazine, p. 375.) It is expected that the ship of that expedition, the *Frithiof*, will be ready to start about the middle of August. Lieutenant Blom of the Swedish navy, who, two years ago, accompanied the trigonometrical survey expedition to Greenland, has been appointed second in command. The young Swedish zoologist, Baron Klinckowström, will also accompany the *Frithiof*. Three expeditions are thus now hurrying to the rescue of Nordenskjöld and his companions; the Swedish, on board the *Frithiof*; the Argentine, in the *Uruguay*; and the French, in the *Français*. The last-named is to be under the command of Dr. Jean Charcot, who has entirely altered his original plans (*cf.* this Magazine, pp. 155 and 331), and now proposes to attempt to reach the South Pole and relieve Nordenskjöld *en route*.

Captain Amundsen's Magnetic North Pole Expedition left Christiania on June 16 on board the ship *Gjoa*. The expedition has thus been delayed, for the original intention was to start in April, *cf.* this Magazine, p. 155, where the plan of the expedition will be found detailed.

GENERAL.

Fish-eating and Leprosy.—In the *Times* for May 25 there is a letter from Mr. Jonathan Hutchinson containing some further information in regard to his observations on the causation of leprosy. He points out that he does not suggest that the consumption of sound fish has anything to do with the disease, it is only tainted fish which may induce it. He further emphasises again the great prevalence of the disease among Roman Catholic converts to Christianity, and urges upon that church the necessity for some modification of the regulations as to fast days in the case of Asiatic converts. Mr. Hutchinson calculates that conversion to the Catholic faith in the case of Hindus increases the risk of leprosy twenty to ninety times as compared with non-converts, this increased liability being directly due, in his opinion, to the imposition of one to two fish fast days in each week.

Again, the existence of the salt-tax is indirectly responsible for the prevalence of leprosy by preventing the adequate curing of fish. The recent diminution of leprosy in certain districts of India is ascribed by Mr. Hutchinson to the remission by the Government of this tax in the case of large fish-curing establishments, and if the tax were totally abolished, the result would to a large extent render a fish diet harmless. Finally, Mr. Hutchinson remarks upon the short-sighted policy which spends large sums of money on leper establishments, while it is apparently impossible to obtain money for research which would possibly render the establishments totally unnecessary within a short time. The Polyclinic Institution has for the last five years had a standing committee engaged in the study of the leprosy question, but the Institution is poor, and the work has been greatly hampered by the want of funds.

Modern Methods of Construction of Maps and Charts.—In a recent paper on this subject, read before the Society of Arts, Mr. G. T. Morrison gave a clear and instructive account of orthographic, stereographic, Mercator's gnomic and elliptical projections, which should prove of great value to teachers and others. Mr. Morrison thinks that for the purpose of teaching geography a projection based, not on distinct mathematical rule, but on a system of compromise, is on the whole the best one, for example, one on which the meridians and parallels are spaced at equal distances throughout.

Observations on Longitude at London and Paris.—The annual report to the Conseil de l'Observatoire de Paris, prepared by M. Maurice Loewy contains an account of the recent observations made at Greenwich and Paris for the determination of the difference of longitude between the two observatories. In each observatory a French and an English astronomer made observations independently in the spring and autumn of last year, and it is stated that the discussion of the two series shows no sensible difference between the French and English results.

South-eastern Union of Scientific Societies.—The Annual Congress of these Societies was held at Dover, on June 11-13. On Thursday evening, June 11, the president, Sir Henry H. Howorth, delivered the annual address. On June 12 the following papers were read :—"Atmospheric Moisture as a Factor in Distribution," by Mr. A. O. Walker; "Experiences of Leprosy in India," by Dr. Jonathan Hutchison, F.R.S.; "The Diminution and Disappearance of South-eastern Flora and Fauna within the Memory of Present Observers," by Captain M'Dakin and Mr. Sidney Webb; "The Seedlings of Geophilous Plants," by Miss Ethel Sargent; "The White Chalk of Dover," by Dr. Arthur Rowe; "A late Keltic Cemetery at Harlyn Bay," by Rev. R. Ashington Bullen. On June 13 Mr. A. T. Walmesley lectured on international communication.

General Circulation of the Atmosphere.—Dr. Hildebrandsson has published, as Part 1 of the *Rapport sur les Observations Internationales des Nuages au Comité International Météorologique* (Upsala, 1903), a general historical account of the theories of the general circulation of the atmosphere held by various authors, together with an examination of the results of cloud observations made at stations in different parts of the world in their bearing on these theories. His general conclusions are as follows :—"(1) Above the thermal equator and the equatorial calms there is, throughout the year, a current from the east which seems to have a very high velocity at a great altitude. (2) Above the Trade Winds there is a return Trade, from south-west in the northern, and from north-west in the southern hemisphere. (3) This return Trade does not pass beyond the northern limits of the Trade. It is diverted more and more to the right in the northern and

to the left in the southern hemisphere, so that it is converted into a westerly current above the crest of the barometrical maximum of the tropics, and it descends and reinforces the Trade Winds. (4) The regions situated on the equatorial edge of the Trade are included in the Trade, or in the equatorial calms, according to the season. (5) The barometrical pressure diminishes gradually from the tropical high pressure towards the poles, at least beyond the polar circles. Further, the air of the temperate zone is drawn into a vast "polar whirl," turning from west to east. This turning movement seems to be of the nature of an ordinary cyclone ; the air of the lower strata approaches the centre, and that of the upper strata is drawn away, with altitude, from the surface of the earth, up to the highest altitudes of which we have any cognisance. (6) The upper layers of the atmosphere in the temperate zones extend over the high pressures of the tropics and descend there. (7) The irregularities which we find on the surface of the earth, especially in the monsoon regions of Asia, generally disappear at the level of the lower or intermediary clouds. (8) We must therefore give up absolutely the idea of a vertical circulation between the tropics and the poles, which has been hitherto accepted by Ferrel and James Thomson."

Meteorological Exhibition at Southport.—The following circular has been issued by Mr. Shaw of the Meteorological Office, and we have pleasure in calling the attention of our readers to it :—

"In connection with the meeting of the International Meteorological Committee at Southport, during the session of the British Association in September next, it is proposed to make arrangements for an exhibition of meteorological appliances and other objects of Meteorological interest.

"Upon the initiative of the Meteorological Council, with the co-operation of the Royal Meteorological Society and the Scottish Meteorological Society, who have appointed representative members, a committee has been formed to carry out this proposal.

"In order to divide the work of collection and organisation it is proposed to group the exhibits into four classes ; those who are willing to co-operate are requested to communicate at once with the gentlemen named below, who have kindly undertaken to receive, on behalf of the committee, intimations and suggestions as to objects of meteorological interest for exhibition.

"*A.* Meteorological Statistics.—Dr. H. R. Mill, 62 Camden Square, N.W.

"*B.* Weather Telegraphy.—Mr. W. N. Shaw, 63 Victoria Street, S.W.

"*C.* Atmospheric Physics.—Captain Wilson-Barker, H.M.S. *Worcester*, Greenhithe, Kent.

Including (*a*) Meteorological Photography ; (*b*) Instruments, and Instrumental Records ; (*c*) High Level Stations, Balloons, and Kites ; Observations and Records ; (*d*) Experimental Illustrations.

"*D.* The Relation of Meteorology to other branches of Physics.—Mr. A. R. Hinks, The Observatory, Cambridge.

"The opportunities for a gathering of the meteorologists of other countries in the United Kingdom have been comparatively rare. The committee invite workers in meteorology and allied branches of physics to co-operate on this occasion in the formation of an exhibition which shall adequately represent the position of this country with regard to the prosecution of those sciences.

"The Meteorological Council have sanctioned a proposal to have a selection of the official telegraphic reports repeated daily to Southport during the meeting, to be charted and dealt with by a member of the staff of the Office in connection with the Exhibition."

Origin of the Aryans.—In the *Rivista Geografica Italiana* for April appears a long and interesting article on this subject. It is treated first of all from the historical and linguistic standpoint; the geographical point of view is represented by the opinions of Ratzel, while the modern anthropological view is illustrated by quotations by Sergi and other authorities.

COMMERCIAL GEOGRAPHY.

Commerce in the Philippines.—In *Dun's Review* for June there is an instructive article on the progress of trade in the Philippines since the American occupation. The customs statistics show that there has been a uniform increase in the exports since the American occupation. Imports have also steadily increased until the latter half of last year, when there was a moderate decline, due to the disturbed financial situation, the rinderpest, and the cholera epidemic, all of which affected the prosperity of the farming districts. The hemp industry is suffering from two causes: first, the fact that the natives widely use a saw-edged knife which increases the yield of fibre per day, but results in an inferior product, whose inferiority is very difficult to detect, even by the experienced buyer. The Government proposes to prohibit the use of such knives, and to appoint inspectors to see that the regulation is carried out. Again, the planters have not sufficient capital to wait until their crops are ready for market, and it is the universal practice for the dealers to advance money on the growing crops, a system which introduces a large amount of uncertainty into the trade, and has been very detrimental to its development. The sugar industry has had its development checked owing to a variety of causes, the most conspicuous being the exclusion of Chinese labour since the American occupation, and the action of Congress in refusing to admit Philippine sugar duty free. The tobacco industry is capable of great development, and the introduction of Chinese labour would greatly facilitate the growth of the industry.

Kermanshah.—An elaborate report on the city and province of Kermanshah, in Western Persia, by Mr. Rabino, agent in Kermanshah of the Imperial Bank of Persia, has recently been published by the Foreign Office Diplomatic and Consular Reports, Miscellaneous Series, No. 590. Mr. Rabino states that the bazaars, though smaller than those of Teheran, are well stocked with goods of all kinds, especially Manchester prints. The merchants are commission agents for principals in Hamadan and Baghdad, the town being situated on the main caravan-route from Mesopotamia to Persia, 220 miles from Baghdad and 330 from Teheran. There are about 200 merchants, dealing mostly in Manchester goods, obtained direct from Manchester or through Baghdad, and in opium, goat skins, guns, carpets, and wool which they export to Baghdad and England. About 20 Ottoman Jews have the greatest part of the foreign trade in their hands, and there are also Hamadan, Ispahan, Yezd, and Kashan merchants dealing in goods from these districts and sending foreign goods to them. The city is growing in commercial importance, in spite of oppressive government and bad roads, on account of its being the frontier town on the trade-route between Baghdad and Persia. Mr. Rabino says that Russian trade there is increasing, and that only the cost of transport from Hamadan prevents this trade from increasing still more. The total imports from Baghdad during the official year ended March 20, 1902, amounted to £865,740, and the exports to £182,730. Of the imports, Manchester goods reached £654,398, while opium absorbed more than a third of the exports. "It is evident," says Mr. Rabino, "that if the Baghdad railway be constructed,

and if it be extended to the Persian Gulf, it will do much to increase the importance of the Kermanshah route and of the town as a port of entry for Persia. When it is considered that from Basra to Baghdad by the Shatt-el-Arab and the Tigris the distance is 510 miles, whilst as the crow flies the distance is only 300 miles, and that now it costs as much to send goods from Basra to Baghdad as to get them from London to Basra, one will easily imagine the enormous impetus which will be given to the Kermanshah trade by the cheapening of the cost of transport, a natural result of the railway to Khanekin and the Gulf."

The Cape-to-Cairo Railway.—Reuter's Agency is informed that steps have been taken to begin immediately the construction of the section of the Cape-to-Cairo Railway between Wankie and the Zambesi at Victoria Falls and that 2500 labourers will at once commence work on this section. Railhead will be at Wankie, about 200 miles north-west of Bulawayo, very shortly. With regard to other railways in Rhodesia, on the branch line between Bulawayo and Gwanda 31½ miles of rail have been laid of a total length of 104 miles. The Selukwe line will be finished at an early date, as the rails have already reached a point 16 miles from Gwelo and sufficient material is now on the spot for the completion of the branch. The removal of the light rails on the Vryburg-Mafeking section is rapidly proceeding, and, according to the latest advices, 42 miles out of the total 96 had been relaid with 60 lb. rails.

Trade in the Congo State.—The number recently issued of the Official Bulletin contains the annual report of the trade of the Congo State during the year 1902. The total trade for the twelve months reached the following figures:—Exports 56,962,349f., and imports 20,699,723f. As part of this trade is merely in transit to French or Portuguese territory, the true totals for exports and imports from and to the Congo State alone become 50,069,514f. and 18,080,909f. respectively. In plain English this means two millions sterling of exports and £720,000 of imports. There has been a very considerable decline in imports, which in 1900 were close on a million sterling. There is also a remarkable increase in the exports, which in that year only slightly exceeded a million sterling. The principal article of export continues to be rubber, which represents four-fifths of the total export. Increases are noted in the export of coffee and cocoa, but their cultivation, although there are indications of progress, is still on too modest a scale to make any imposing show in tables of statistics. The low figures of the imports are attributed by the official reporter to passing causes, such as smaller purchases by the State of river boats, railway materials, and munitions of war. With regard to the countries importing into the Congo State, Belgium has rather more than 60 per cent., England 15 per cent., France 7, and Germany 6. Holland and Portugal account for the greater part of the balance, and the United States imports are valued at only £1200.

Cotton-Growing in Africa.—In a report to the Foreign Office on the German Colonies, Mr. Buchanan, the secretary to the British Embassy in Berlin, writes:—The conditions of the soil and climate in Togoland are, it is believed, favourable to the growth of cotton, and the natives, by whom it has long been cultivated in many parts of the country, have shown considerable readiness and intelligence as regards the adoption of American methods of cultivation. Experimental stations have been started at Tove and other places, under the supervision of American experts; and the cotton is brought down to Lome on mules and oxen, previously inoculated with Dr. Schilling's anti-"Surrah" serum, which has been found very efficacious as a preventative of that disease. Some 108,000 lbs. of cotton

grown during the year 1901-2 from native (Togoland), American and Egyptian seed were shipped to Bremen, where on examination by experts, that produced from native seed was pronounced as slightly superior to, and that from American seed slightly inferior to, "middling American." The Egyptian seed cotton came last in their estimation. Experiments are now being made to produce, by crossing, a variety combining the qualities of both the native and the American cotton plant. The reports sent home as to the existence of wild cotton in many parts of the districts between the coast of the East African Protectorate and the Great Lakes, induced the Colonial Economic Committee in June 1901 to institute similar experiments in that colony. The delta of the Rufiji and the Kilwa district are said to offer the best promises of success, and experiments have already been made in the latter region with Egyptian, American, and Indian seeds. The first of these three seeds appears to have furnished the best results, and the samples of cotton sent home have been classed by the Bremen Cotton Exchange as on a par with Egyptian cotton. An expert has recently been sent from East Africa to study cotton growing in the United States, and to select a staff of cotton planters to work under him on his return to the colony.

The Albula Railway to the Engadine.—The new railway connecting Thusis with the Engadine was opened to traffic at the beginning of July, and in boldness of construction it vies with the famous Gotthard line. It goes along the Schyn Pass from Thusis as far as Tiefenkastell and thence past Alvaneu Bad and Filisur to the Albula Pass, which is pierced by a tunnel of three miles and 1133 yards. The point where the boring parties met, working from either end of the tunnel, was 5981 feet above the level of the sea. The terminus of the line is at Celerina in the Engadine Valley, which is at present connected by omnibus or carriage with the real destination, St. Moritz, a mile and a half off. Next year it is expected that the line will be open to St. Moritz. Instead of making the long diligence journey it will now be possible to reach the Engadine by express train twice a day in less than four hours from Chur.

The Simplon Tunnel.—The work at this tunnel is proceeding rapidly on both sides of the Alps, and it seems now certain that it will be completed by the date estimated, the beginning of July. About 4000 workmen are employed in the tunnel, and no fewer than 6000 on the Italian section of the line between Isella, at the mouth of the tunnel, and Arona, the present terminus of the line running north from Milan. One of the great obstacles to the work has been the ever-increasing heat of the tunnel, into which water percolates through beds of lime-stone, and attains a temperature of from 112 deg. to 140 deg. F. as it enters the tunnel, making artificial refrigeration imperative. By means of it the internal temperature of the tunnel has been reduced to 70 deg. The volume of water flowing from the south end of the tunnel is over 15,000 gallons per minute, and furnishes power enough to work the refrigerating apparatus, and to compress the air by which the drills are worked. When completed the tunnel will be the longest in the world, for it will reach a length of fourteen miles, as against seven miles for the Mont Cenis and nine for the St. Gotthard tunnel.

The Benguella Railway.—This line is to run from Lobito Bay in Portuguese West Africa to the Congo-Rhodesian frontier, and is now making satisfactory progress. Large parties of surveyors are engaged on the western end of the line, and are working eastwards. The route is some 900 miles in length, and it is estimated that the complete survey will take two to three years, and the railway construction about four years. The survey of the first two hundred miles through Benguella

has been completed, and the work of construction has been begun. At the end of May 1200 tons of rails had been already shipped to Benguella. The engineers at Lobito Bay are now engaged in constructing earthworks, and rail-laying has begun. The line is of 3 ft. 6 in. gauge.

Gold in Tunis.—It is announced that rich auriferous deposits have been found around Kairwan and Sidi-bou-Said, while the sands of Susa and Bizerta are also rich in gold. The richest samples of the gold-bearing reefs have given one hundred grammes to the ton of ore, and the less rich twenty-five grammes. The ore is stated to be an oxide of iron. The veins are not continuous in character, but apparently extend to about a thousand metres.

The Iron Ore Fields in North Lapland.—The railway connecting the Gulf of Bothnia with the Atlantic from Lulea to Narvik close to the Russian frontier is to be opened throughout its whole length next summer. The railway has been built by the Swedish and Norwegian governments in conjunction, and has for its object the facilitating of the export of the immense quantities of iron ore found at Kirunavaara and Gellivara.

NEW BOOKS.

EUROPE.

Norwegian By-ways. By Charles W. Wood. London: Macmillan and Co., 1903. Pp. 384. *Price* 6*s*.

A gossipy account of a tour through Norway agreeably written, and giving rather the social pleasantries of the voyage than much information regarding the country. The illustrations are good, but there is neither map nor index.

L'Architecture du sol de la France: Essai de géographie tectonique. By Commt. O. Barré. Paris: Libraire Armand Colin. 8vo. Pp. 393.

This book is, in the words of the author, an essay to elucidate the *pourquoi des choses* in the physical geography of France. It is also, however, a valuable addition to the number of studies in the field of general and more or less speculative geology, pioneered so ably by Dana. The inorganic continuity of the earth is a fact one is too apt to forget. Herculean crustal movements may be overlooked in tracing a little local fault. The world may be obscured by the stones. To such a tendency our author provides an excellent antidote. Geologists and geographers meet on common ground to inquire why the mountains of France are where they are, and to trace the relation, if any, between their contour and their geological structure.

In the general and introductory portion an admirable summary is given of the processes which have co-operated to produce the present contour of the surface. We are reminded at the outset that geography and geology are, like the world of Heraclitus, in a state of eternal flux. Each is constant for an instant only. The present, moreover, is the result of the past; and to understand aright the actual form of the surface, it is necessary to know the geography of the past and to trace the progressive changes during geological time. The importance of the study of sedimentary rocks as indices to former physical conditions is emphasised. A somewhat antiquated classification of igneous rocks is provided; and attention is

called to their spasmodic appearance in time, coincident to some extent with the dislocations of the crust. The crust itself is fantastically pictured as a suit of jointed armour enclosing the nucleus. The lines of articulation or geosynclinals are areas of maximum mobility, while the polygonal areas marked off by the network of geosynclinals are areas of minimum mobility. The sinking of these so-called "continental areas" upon the contracting nucleus has caused repeated movement especially in the neighbourhood of the geosynclinals. The movements may take the form of faults, or of folds and thrusts; the faults giving origin to *l'architecture tabulaire* of dislocation mountains, while the folds and thrusts result in *l'architecture plissée* of folded mountains. The significance of unconformabilities is insisted upon, as well as the slow and sluggish nature of the crustal movements themselves. At times in geological history there have been accelerations in the rate of movement: these are *époques critiques* at each of which certain parts of the crust have been impressed with either a tabular or a folded type of architecture. There is apparently no law to decide the type of movement in any particular region in successive epochs. A district folded during one epoch may be dislocated or folded quite arbitrarily in the next. The earlier movements appear, however, to exert a "directive influence" upon the later, inasmuch as the principal axes of movement are more or less adjacent and parallel during successive epochs. An interesting account of the sculpture of the surface by epigene agents is followed by an explanation of the apparent paradox of rivers being older than the mountains from which they flow.

A section of the introduction is devoted to a summary of the views of MM. Bertrand and Haug on the geographical evolution of the European region. According to these authors, two great continental areas have existed in the Atlantic region with minor oscillations since the beginning of time: one to the north, stretching from the Rocky Mountains over the site of the North Atlantic, the other to the south, extending from the Andes to the eastern shore of Africa. To the west the continents were bounded by a great geosynclinal which occupied the site of the Rockies and the Andes: to the east a similar trough stretched from north to south. A third ramifying geosynclinal extended east and west, and occupied a mediterranean position, separating the two great continents. Its eastern extremity at various periods covered practically the whole of the present Europe. As a consequence of the sinking of the continents upon the cooling nucleus, movement took place in the areas of maximum mobility at different epochs. In the mediterranean geosynclinal there have been four periods of organic activity, giving rise to four folded zones which have been termed Huronian, Caledonian, Hercynian, and Alpine. These zones succeeded each other in order from north to south, and also in time, the successive movements taking place towards the end of the Cambrian, Silurian, Carboniferous, and Miocene periods respectively. In tracing their distribution one naturally finds the earlier zones more vague and uncertain than the later. The Huronian is apparently not now represented in the European area: it probably stretched away to the north-west of Scotland and Norway. The Caledonian zone is represented by the crystalline schists and folded sediments of Britain and Norway, its southern limit appearing in the Franco-Belgian district. Rocks of the Hercynian zone are more abundantly represented on the continent. They stretch from Brittany through the central plateau of France, the Vosges, the Ardennes, Alsace-Lorraine, and Central Germany to Bohemia. The northern limit of this zone appears in the cleaved Devonian and Carboniferous rocks of Devon, South Wales, and Ireland. The Europe formed by this upheaval was dislocated during the Triassic period, and a fourth geosynclinal formed to the south of the Hercynian axis in Jurassic and Cretaceous times. Then in the Eocene-

Miocene came the last great critical epoch, the Alpine, resulting in the upheaval of the Pyrenees, the Alps, the Jura, the Carpathians, the Balkans, and the Caucasus Mountains, with the lateral prolongation of the Apennines. The principal axis of folding is bounded to the north by a more or less faulted zone which has superimposed a tabular architecture upon portions of the pre-existing Hercynian mountains.

The Pleistocene period was ushered in by the final dislocation of the great Atlantic continents which had existed unbroken throughout the preceding ages. The British Isles and Brittany have been left to tell the tale. Evidently M. Barré is no believer in the antiquity of the ocean basins. He feels, moreover, so sure of his position that he bases on it a further hypothesis, and adds another to the many suggestions of the origin of the Ice Age. According to him, the breaking of the barrier between the polar and the equatorial seas, and the consequent mixing of the waters, caused such a rapid decrease in temperature and such extraordinary atmospheric condensation that the whole of the northern part of Europe was speedily buried in ice. He concludes the section by reminding us that the repose of the present is merely relative, that the giant powers beneath the crust are only dormant, not dead, and that Great Britain and Ireland, and even France herself, are probably destined to be still more completely parcelled out in the future.

The author then proceeds to the detailed exposition of the relation between the physical geography and the geology of France. In his own words, he accompanies the reader on a tour through France, pointing out how the architecture or geological structure is everywhere mistress, forcing the sculpture to adapt itself to the most ancient as well as to the most recent constructions. The pages are plentifully illustrated with an excellent series of clear and suggestive maps, sections, and diagrams. The style is easy and fluent, the matter well arranged and treated in an interesting manner. One is struck with the wealth of detail which must have been mastered, before the present judicious selection could have been presented. The book will certainly repay careful study, and may well serve as a model of its class.

ASIA.

The Island of Formosa, past and present. By James W. Davidson, F.R.G.S., Consul of the United States for Formosa. London and New York: Macmillan and Co., 1903. Pp. 646. *Price* 25*s.*

Written in Formosa after eight years' experience of the island, printed in Yokohama, Japan, this important work is a valuable product of the Far East. Its author claims that it is the first book in the English language which deals with Formosa in an exhaustive manner. Certainly he has spared no pains to render it complete, and it will be for all time a reliable book of reference on the history, people, resources, and commercial prospects of Formosa, and on its tea, camphor, sugar, gold, coal, sulphur, economical plants, and other productions.

Mr. Davidson has laid the geographical world under a further debt by publishing with this work a fine map of Formosa from the latest Japanese Government surveys, with nomenclature showing Japanese and Chinese pronunciation, for, as the pronunciation of each place differs, so each place seems to have two names. This map was drawn by an expert of the Japanese government in Formosa, and engraved and printed in Tokyo, Japan. Mr. Davidson has also compiled an industrial map showing the forests, mineral fields, and agricultural districts of Formosa, which is an excellent piece of work.

Formosa has half the size and population of Scotland, and was ceded to Japan in 1895, since when its internal state and commerce have greatly improved. The

author estimates that of the trade of the island the United States has about 45 per cent., Germany 20 per cent., Britain 20 per cent., and other Western countries 15 per cent. No product of Formosa has shown such rapid growth and has such a bright future as gold. The author eulogises the work of the Japanese administration, and considers that the methods of modern science and progress which it has introduced into the island will ensure the prosperity of Formosa.

Cities of India. By L. W. Forrest, C.I.E. Westminster: Archibald Constable and Co., Ltd., 1903. *Price* 10*s.* 6*d.*

This book is from the capable hands of Mr. Forrest, the ex-Director of Records to the Indian Government, who is already well-known to the English public as an authority on Indian history. In this volume he gives us a graphic, and indeed romantic description of fifteen of the principal cities and towns in India, based on personal observation, and fortified and enlivened by his almost unique knowledge of their former history, drawn from the official records. Even those who have spent the greater part of their lives in India will be grateful to Mr. Forrest for a work which cannot fail to evoke many pleasant memories and to impart much interesting information. Almost any of the chapters would furnish excellent material for quotation, but we select his description of the famous Kutb Minar at Delhi, as a good example of Mr. Forrest's delightfully simple but highly polished style, his felicitous power of description, and his ample knowledge of architecture, without which any one attempting to describe an Indian city would be badly handicapped. "The Turki slave (Kutb-ad-Din), not contented with erecting a mosque from the materials of the infidel temples, determined to build a tower which should mark the triumph of Islam over the foul worship that prevailed in them, and from whose summit the Faithful should hear the Muezzins (criers) proclaim the Ezan or public invitation to prayer in the name of God and His prophet. Far over the ruins of Delhi soars the tapering shaft which bears his name. By sublime massiveness and subtle alterations the architect has created a transcendent building. The purplish red of the sandstone at the base is finely modulated through a pale pink on the second story to a dark orange at the summit, which harmonises with the blue of an Indian sky. Dark bands of Arabic writing round the three lower stories contrast with the purple red. The Hindus whom the Maslim conquerors employed to erect and embellish their buildings wrought cunningly and with knowledge. His great aim, as Ram Raz points out in his work on Hindu architecture, was to produce beauty by geometrical proportion. The height of the column (238 feet 1 inch) is exactly five times the diameter, and that of the lower story twice the diameter. The plinth is a polygon of twenty sides; the basement story has the same number of faces formed into convex flutes which are alternately angular and semi-circular, the next has semi-circular flutes, and in the third they are all angular. Then rises a plain story, and above it soars a partially fluted story, whose shaft is adorned with bands of marble and red sandstone. A bold projecting balcony, richly ornamented, runs round each story and affords relief to the eye. After six centuries the column stands as fresh as on the day it was finished."

The book is equipped with sixty beautiful photographs, which so far as it is possible to do so, give the reader a good idea of the scenes and places they depict. Mr. Forrest has indented freely on the old records of John Company, and even those to whom his story is a thrice-told tale will be ready to acknowledge that from his pen it bears repetition. To those who have never been east of Suez this work may be heartily commended as of unquestionable historical interest and literary merit.

AFRICA.

The Nile Reservoir Dam at Assuan and after. By Sir William Willcocks, K.C.M.G. Second edition, 1903. London: E. and F. N. Spon. 27 pp.

Sir William Willcocks is a man of genius and an overflowing reservoir of great ideas and imperial engineering projects, some of which he has lived to see successfully carried out, while others are still in the embryonic state. The great Assuan dam will always remain a monument to his engineering skill, for he it was who planned the structure; and the opening of the sluices on 10th December 1902, when the work was officially finished, was an event of far-reaching importance not only to Egypt but to the science of irrigation and river-engineering in general, of which he is one of the leading exponents. In this volume an account is given of the various plans that were considered for a reservoir dam in the Nile, and a detailed description of the modification of the author's design that was finally adopted by the Egyptian Government. The dam, as finally completed in 1902, is not nearly so high as Sir William would like, and he is of the opinion that the straight line that was chosen for the structure to follow is a mistake from an engineering point of view, although more majestic in appearance than the series of small dams with islands between them that he wished to build at first. "Egypt has," he says at p. 8, "to be congratulated on the fact that when it thought it had a dam capable of impounding thirty-five milliards of cubic feet of water, it has a dam capable of impounding seventy milliards" when finally raised to its full height in what he thinks will be the near future. The building was reduced in height to prevent the Philae temple being submerged; the temple, he says, "dedicated to Venus will like Venus herself rise annually out of the water, renovated and refreshed by her temporary immersion, and future generations will wonder why so trifling a matter as the periodical immersion of a temple built of the soundest sandstone on a granite foundation was allowed at one time to assume proportions so ridiculously exaggerated."

A large part of the book is occupied with sections and maps showing how the upper part of the Nile and the great lakes beyond Khartoum may one day be regulated and controlled so as to improve still further the agriculture of Egypt and the Sudan, and minister to the needs of a vast region practically waste just now. Sir William has large ideas, and it may not be many years till some of them become accomplished facts. "Fortunately," he concludes, "for Egypt as for India, her destinies have been in the hands of men to whom irrigation has always represented the foundation stone of permanent prosperity. . . . Well would it have been for . . . Australia and South Africa if their statesmen had been educated in Egypt and India, and had spent on irrigation works one half of the sums which they have spent on communications and railways." Neither Australia nor South Africa have a Nile to feed them, it is true, but the author's words should be pondered by all well-wishers of the Southern colonial empire, where recent experience should lead to far more attention to the importance of great irrigation works and great engineers to carry them out.

AMERICA.

L'Amazonie. Par Auguste Plane. Paris: Librairie Plon, Plon-Nourrit et Cie, Imprimeurs-Editeurs, 1903. *Prix 4 francs.*

M. Plane is already favourably known to us by his volume on "Peru." In the work now before us he describes the tract of Brazil, through which the Amazon and its affluents flow. But the point of view from which he proceeds is not that

of the geographer: on the contrary, it is frankly the more prosaic but profitable one of the dealer in caoutchouc. In this volume we have a comprehensive view of the present condition, extent, and prospects of the caoutchouc trade in Amazonia. Incidentally there are notices of previous events in the history of the country, and we can gather as we read a good deal of information regarding the people, the climate, the appearance and physical conditions of the region; but even on M. Plane's own showing the country offers but little attractions to any one who is not either buying or selling caoutchouc. Traces of gold and of coal, and of some other valuable minerals, have been found, but not in sufficient quantity to encourage enterprise. On the other hand, there can be no doubt as to the deadly and ubiquitous malarial fever, and the equally ubiquitous, and if the latest pronouncements of science are to be believed, the equally deadly mosquito. The book has been written to promote the interests of France in the caoutchouc trade with Brazil, and sets forth "a plain unvarnished tale," but whether this tale is calculated to induce more French emigration, or to draw more French capital to Brazil, is at least open to question.

GENERAL.

Handbook of Climatology. By Dr. Julius Hann. Part I. General Climatology, translated by Robert de Courcy Ward. New York: The Macmillan Co.; London: Macmillan and Co., 1903. Pp. 412. *Price* 12*s.* 6*d.*

This book was translated that it might become the text-book in general climatology in Harvard University, and we cordially agree with the translator, Professor Ward, in hoping that its publication will benefit the study and teaching of the subject of Climatology wherever the Anglo-Saxon tongue is used.

Dr. Julius Hann, the author of the German original, is so well-known and is such a past master in the school of Climatology, that all criticism is needless, but those who are acquainted with the German will congratulate Professor Ward on the admirable way in which he has edited the work and his marked success in the "cuts" he has made and the general re-arrangement of the book for class-room use.

It may be said that these changes have met the approval of Professor Hann himself. The conversation tables are very useful: they are too frequently omitted in works of this kind.

All students and teachers of Climatology will be grateful to the author and the translator for their work.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Chota Nagpore, A little-known Province of the Empire. By F. B. Bradley-Birt, B.A., I.C.S. With an Introduction by the Right Hon. the Earl of Northbrook, G.C.S.I. Med. 8vo. Pp. xiv + 310. *Price* 12*s.* 6*d. net.* London: Smith Elder and Co., 1903.

L'Architecture du Sol de la France. Par Comm^{t}. O. Barré. Med. 8vo. Pp. iii + 393. Paris: Librairie Armand Colin, 1903.

A Guide to Chamonix and the Range of Mont Blanc. Pp. xiv + 206. *Price* 3*s.*

A Guide to Zermatt and the Matterhorn. By Ed. Whymper. Pp. xix + 224. *Price* 3*s.* London: John Murray, 1903.

The Rhine from Rotterdam to Constance: Handbook for Travellers. By Karl Baedeker. Pp. xxxiv + 456. Leipzig: Karl Baedeker, 1903.

Berlin and its Environs; Handbook for Travellers. By Karl Baedeker. Pp. x + 237. Leipzig: Karl Baedeker, 1903.

Die Kunst d. Arabische Sprache durch Selbstunterricht zu erlernen. Von B. Manassewitsch. Pp. viii + 186. *Price M.* 2. Wien: A. Hartleben's Verlag, 1903.

Danish Self-Taught with Phonetic Pronunciation (Thimm's System). Edited by W. F. Harvey, M.A. Crown 8vo. Pp. 120. *Price, wrapper* 2*s.*, *cloth* 2*s.* 6*d.* London: E. Marlborough and Co., 1903.

La Stella Polare, nel Mare Artico. Per Professor Guiseppe Ricchieri della R. Università di Messina. Pp. 80. Messina, 1903.

Quali Insegnamenti si possono trarre dai Disastri di Modica. Per Professor Guiseppe Ricchieri. Pp. 17. Mantova, 1903.

La Tripolitania e l'Italia. Per Professor Guiseppe Ricchieri. Pp. 62. Milano, 1902.

The All Red Line: The Annals and Aims of the Pacific Cable Project. Edited by George Johnston. Crown 8vo. Pp. 486. London: Edward Stanford, 1903. *Price* 6*s.*

La Savoie, Guide du Touriste, du Naturaliste et de l'Archéologue. Par Joseph Révil et Joseph Gorcelle. Pp. 273. Masson et Cie., Paris, 1903. *Price* 4 *frs.* 50.

The Eastern Alps, including the Bavarian Highlands, Tyrol, etc. Tenth edition, revised. Leipzig: Karl Baedeker, 1903.

Switzerland and the adjacent portions of Italy, Savoy, and Tyrol. Twentieth edition. Leipzig: Karl Baedeker, 1903.

Also the following Reports, etc.:—

The British Empire Year Book, 1903. An annual statistical volume of reference, compiled with the assistance of H.M. Imperial and Colonial Government by Edgar G. Wall. Med. 8vo. Pp. viii + 1276. *Price one guinea net.* London: Edward Stanford, 1903.

Geographical Index (extra-European) to Books, Periodicals, etc. Compiled in the Intelligence Division, War Office, by Alex. Knox, B.A., Map Curator, 1902. London, 1903.

Bibliotheca Geographica herausgegeben von der Gesellschaft für Erdkunde zu Berlin bearbeitet. Von Otto Baschin. Band viii. Jahrgang, 1899. Pp. xvi + 511. Berlin: W. H. Kühl, 1903.

Die Wirtschaftliche Erschliessung Aethiopiens und der Österreichische Export. Von Friedrich J. Bieber. Pp. 33. Wien, 1903.

Geographen-Kalender. Von Dr. Hermann Haack. Erster Jahrgang, 1903-1904. Pp. xv + 444. *Price M.* 3. Gotha: Justus Perthes, 1903.

Report on the Administration of Bengal during 1901-1902. *Price* 9*s.* Calcutta, 1903.

Annuaire Agricole, Commercial et Industriel des Colonies de la République Française 1903-1904. Société de l'Annuaire Colonial. *Price* 6 *francs.* Paris, 1903.

Publishers forwarding books for review will greatly oblige by marking the price *in clear figures, especially in the case of foreign books.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., and LAURENCE PULLAR, F.R.S.E.

INTRODUCTORY.

DURING the years 1883 and 1884 the Royal Societies of London and Edinburgh urged Her Majesty's Government to undertake a bathymetrical survey of the principal Scottish fresh-water lochs. The Government, however, declined to undertake such a survey, because this work did not fall within the scope of the Ordnance Survey nor of the Hydrographic Department of the Admiralty.[1] In the years 1897 and 1898 Sir John Murray and the late Mr. Fred. Pullar, F.R.S.E., commenced to sound systematically some of the more important of the Scottish lochs, on the lines indicated in the letter addressed to Her Majesty's Government by the Royal Society of London in the year 1884. The results of these observations were published in the years 1900 and 1901, in two papers dealing with the lochs of the Forth basin and two of the lochs of the Tay basin.[2] Arrangements had been completed for carrying on this survey during the summer of 1901, but the whole work was brought to a standstill by an unfortunate ice-accident in Airthrey loch, near Bridge of Allan, on February 15, 1901, in which Mr. Fred. Pullar lost his life while gallantly endeavouring to save others.[3]

[1] This correspondence is published in the *Geographical Journal* (see vol. xv. p. 309, 1900) and in the *Scottish Geographical Magazine* (see vol. xvi. p. 193, 1900).

[2] "A Bathymetrical Survey of the Fresh-water Lochs of Scotland." Part i. *Geogr. Jour.*, vol. xv. p. 309, *Scott. Geogr. Mag.*, vol. xvi. p. 193, 1900; Part ii. *Geogr. Jour.*, vol. xvii. p. 273, *Scott. Geogr. Mag.*, vol. xvii. p. 113, 1901; Part iii. No. 1, *Geogr. Jour.*, vol. xvii. p. 289, *Scott. Geogr. Mag.*, vol. xvii. p. 169, 1901.

[3] See *Geographical Journal*, vol. xvii. p. 313; *Scottish Geographical Magazine*, vol. xvii. p. 148, 1901.

FIG. 1.—THE LATE FRED. P. PULLAR, F.R.S.E.

(From a photograph by Sir John Murray, taken on the shores of Loch Leven, September 1, 1900. *Lunch-time on his last sounding expedition.)*

FIG. 2. SIR JOHN MURRAY, K.C.B.

(From a photograph taken by the late F. P. Pullar, F.R.G.S., during lunch-time on their last sounding expedition together. Loch Leven, September 1, 1900.)

The tragic death of this rising young geographer produced a profound sensation in the community in which he lived and amongst his numerous scientific and other friends; various local memorials have been established to his memory.[1]

Some time after the death of his son, Mr. Laurence Pullar approached Sir John Murray with regard to the feasibility of continuing and completing the work so unfortunately interrupted; he expressed his willingness to fill his son's place as far as possible, and, at all events, to set aside a sum of money sufficient to pay for such assistance as Sir John might desire in carrying on the work and publishing the results. He was even in favour of the scope of the work being extended so as to include all the inland waters of the United Kingdom, and to embrace physical and biological observations in addition to the routine sounding work. Mr. Pullar wished to be assured on two points: *first*, that there was no likelihood of any Government Department carrying out such a survey; and, *second*, that the work was considered, by competent authorities, important and desirable from a scientific point of view. In these circumstances the question of the renewal of the survey was submitted to the Councils of the Royal Societies of London and Edinburgh. Both Councils passed resolutions stating that they learned with great satisfaction that arrangements were under consideration for the completion of the survey commenced by Sir John Murray and the late Mr. F. P. Pullar, and confirmed their opinion as to its great scientific importance. A similar resolution was also passed at the British Association meeting at Glasgow in 1901.[2]

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[1] A volume of press and other public and private references to his death was printed for private circulation, and memorial prizes were given at Stirling High School and in connection with the Marine Biological Association of the West of Scotland, etc.

[2] Copy of Resolution passed by the Council of the Royal Society of London, June 1901.

Mr. Teall informed the Council that a number of Fellows and others interested in the subject had heard a statement by Sir John Murray with reference to a bathymetrical, physical, and biological survey of the fresh-water lakes of Great Britain and Ireland. It appeared that the Council had urged the importance of a bathymetrical survey of the principal fresh-water lakes of the country in a letter to Her Majesty's Government, dated May 2, 1884, and that a survey on the lines therein indicated had been commenced, so far as Scotland was concerned, by Sir John Murray and Mr. F. P. Pullar, but had been unfortunately interrupted by the accidental death of the latter gentleman. Mr. Laurence Pullar (the father of Mr. F. P. Pullar) had now intimated to Sir John Murray that he was willing, on certain conditions, to set aside a sum of money to enable this survey to be completed, and to be extended to all inland bodies of water. The conditions were as follows:—

(1) That there was little likelihood of this survey being undertaken by any of the Government Departments.

(2) That Sir John Murray would himself undertake the general superintendence of the survey and the publication of the results.

(3) That, in the opinion of the Council of the Royal Society, it was important from a scientific point of view, in addition to the bathymetrical survey recommended in their letter of May 2, 1884, to undertake at the same time an investigation into the physical and biological conditions of the fresh-water lakes.

As soon as the Council had declared their opinion, Sir John Murray was pre-

Although His Majesty's Government could not see its way to undertake a bathymetrical survey of the Scottish fresh-water lochs, still several Public Departments have taken a deep interest in the work and have given important assistance. A letter was received from Colonel Duncan A. Johnston, R.E., Director-General of the Ordnance Survey, stating that the Board of Agriculture had sanctioned the issue to the staff of the survey of two copies of the 6-inch and one copy of the 1-inch maps of the districts in which lakes were situated, one copy of the former to be returned to the department with the depths of the lakes laid down on it, with a view to the lake-contours being shown on the Ordnance

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pared to draw up an approximate estimate of the cost of the work for Mr. Pullar's consideration.

It was resolved—That the Council confirm the opinion expressed in their letter to Her Majesty's Treasury of May 2, 1884, as to the great scientific importance of a bathymetrical survey of the fresh-water lakes of the United Kingdom, and that they have learned with great satisfaction that arrangements are under consideration for the completion of the survey commenced by Sir John Murray and Mr. Pullar, and are of opinion that the scientific value of the survey will be greatly increased if it embraces a study of the biological and physical conditions of the lakes.

EXTRACT FROM A MINUTE OF MEETING OF THE COUNCIL OF THE ROYAL SOCIETY OF EDINBURGH, HELD ON MAY 24, 1901.

The Council heard a statement from Sir John Murray with reference to a bathymetrical survey of the fresh-water lochs of Scotland to the effect that Mr. Laurence Pullar was willing, on certain conditions, to set aside a sum of money to enable the survey to be completed which had been commenced by Sir John and Mr. Pullar's son, Mr. F. P. Pullar, but which had been interrupted by the unfortunate death of the latter gentleman by accident.

Mr. Pullar was prepared to do this provided Sir John would himself undertake the general superintendence of the survey and the publication of the results; provided, also, that the Council still regarded such a survey as important from a scientific point of view, and that it had been, and was likely in future to be, satisfactorily carried out on the lines suggested by the Council in the year 1884.

Sir John had been requested to prepare an approximate estimate of the cost of completing the survey for Mr. Pullar's consideration, and he now asked the Council for suggestions as to any scientific observations that might with advantage be undertaken in connection with the survey. There was much discussion with regard to researches which might be carried out in fresh-water lochs, and Sir John was asked to assure Mr. Pullar that the Council learned with much satisfaction that arrangements were in contemplation for carrying to a successful completion the admirable survey which had been commenced by Sir John and Mr. Pullar's son, Mr. F. P. Pullar, who was a member of the Society, and whose death they all deplored.

At the meeting of the British Association in Glasgow in September 1901, the President of the Geographical Section (Dr. H. R. Mill) was enabled to announce that definite arrangements had been made to carry on the work; a conference of the Geographical, Geological, and Zoological Sections was held on September 16, 1901, for the purpose of considering the scheme of the survey; the discussion was taken part in by Dr. Mill, Prof. Bonney, Dr. John Horne, Mr. Isaac Thompson, Colonel Johnston, Mr. Ben. N. Peach, Mr. R. M. Clark, Prof. Watts, Mr. Barrow, Mr. Cunningham Craig, Mr. Dickson, Dr. Fullarton, Mr. W. S. Bruce, Mr. Greenly, and the Rev. Frank Knight, and many valuable suggestions were thrown out as to the scope of the work. At the conclusion of the discussion, Dr. Horne formally moved, on behalf of the meeting, the great gratification they all felt that this investigation should be carried out by means of the munificence of Mr. Pullar, and under the administration of Sir John Murray; the resolution was seconded by Mr. Peach, and unanimously adopted.

Survey maps. T. Digby Piggott, Esq., C.B., Controller of His Majesty's Stationery Office, wrote to the effect that no objection would be raised by his department, on the ground of copyright, to the reproduction of Ordnance Survey maps, and publication if desired, in connection with the Lake Survey, on the understanding that the source from which the reproductions are taken is quoted, and due acknowledgment be made of the fact that the consent of the Controller had been obtained. Admiral Sir W. J. L. Wharton, K.C.B., F.R.S., Hydrographer of the Admiralty, also promised the advice and assistance of his department. Through Mr. J. J. H. Teall, F.R.S., Director-General of the Geological Survey, and Dr. John Horne, F.R.S., Director of the Geological Survey of Scotland, Sir John Murray was informed that the Board of Education had sanc-

FIG. 3.—MEMORIAL BRONZE TO F. P. PULLAR, BY G. A. FRAMPTON, R.A., ERECTED IN LOGIE CHURCHYARD, BRIDGE OF ALLAN.

In the central group the hero is shown supported by angel figures, whose wings form a canopy and throw shadows symbolical of the mystery beyond; in front walk heralds carrying a laurel wreath, and behind others playing musical instruments. The legend is, "So He bringeth them unto their desired haven."

tioned the issue to the Lake Survey staff of a complete set of the Geological Survey maps of Scotland, and, in addition, had sanctioned the supply of information which might be asked for by the staff of the Lake Survey during the course of their investigations. This latter privilege has been very largely taken advantage of, and Dr. Horne and the other members of the Geological Survey in Scotland have rendered continuous advice and assistance, and have now given directions for the preparation of maps and notes concerning the surface geology of some of the areas in which the lakes are situated. These maps and notes will form a valuable part of the forthcoming publications.

All plans for carrying on the work having matured during the winter of 1901-1902, a staff was appointed, and a start was made early in the spring of 1902, in the lochs situated in the more northerly part of

the Tay basin, the survey being gradually extended to the lochs northwards of this region.[1]

During the summer of 1902, about 155 lochs were sounded, and the work has been continued during the present summer, over 300 lochs having now (July) been surveyed. It is, indeed, expected that the survey of all the lochs of the mainland of Scotland, together with those of the Outer Hebrides, Orkney, and Shetland, will be completed this year. As a rule, those lochs on which there are now no rowing-boats, or to which boats could not easily be transported, have been omitted in the meantime.

The methods employed in conducting these recent bathymetrical surveys have been essentially the same as those described in the paper communicated to the *Geographical Journal* in 1900.[2] The F. P. Pullar sounding-machine (see fig. 4) has been used in all the larger lochs, but for the smaller lochs situated high up on the hills or otherwise difficult of access, several small machines (see fig. 5) were constructed, which could be carried in the hand and easily fixed to the side of the rowing-boat. The line used was marked in feet in the usual way, and although the soundings took a much longer time, this small machine proved most satisfactory for hill lakes.

The 6-inch Ordnance Survey maps, supplied to the staff by the Ordnance Survey Office, have been used throughout, both in the field and office work. The positions of all the soundings were originally laid down on these maps. Tracings were then made on cloth, and the corrected soundings neatly written in at the correct positions, and the contour-lines of depth drawn. The areas within the various contour-lines were then ascertained by means of the planimeter, and the total bulk of water in the basin calculated from the data thus obtained. The maps to be published with this and succeeding papers are reduced to the scale of 3 inches to 1 mile (1 : 21,120). The soundings are given in feet; in some cases it was not possible to place all the soundings

[1] Mr. T. N. Johnston, M.B., C.M. (Edin.), F.R.S.E., was appointed first assistant and zoologist; Mr. James Parsons, B.Sc. (Lond.), chemist; Mr. James Murray, assistant zoologist; Mr. T. R. H. Garrett, B.A., Jesus College, Cambridge, geologist; Mr. John Hewitt, B.A., Jesus College, Cambridge, zoologist; Mr. James Chumley, secretary, assisted by Mr. Robert Dykes, in charge of office work. Mr. R. M. Clark, B.Sc., Aberdeen, also devoted a large part of the summer to field-work in connection with the survey, and assistance was also given for short periods by Dr. J. Sutherland Black, M.A., F.R.S.E., Sir John Jackson, LL.D., Mr. D. C. M'Intosh, M.A., Mr. James Walker, C.E., and Mr. D. J. Scourfield.

During the last winter Mr. Parsons was appointed to a post on the Mineralogical Survey of Ceylon, and Mr. Garrett was appointed geologist to an East Borneo Company. Their places on the staff have been taken by Mr. R. B. Young, M.A., and Mr. R. C. Marshall, M.A. In the summer of 1903 Mr. E. M. Wedderburn joined the staff, and also Mr. E. R. Watson, B.A., B.Sc., Jesus College, Cambridge, and Mr. Scourfield and others have rendered assistance. Among the boatmen who have been employed, Mr. Hugh Drummond deserves to be mentioned, as he has been continuously employed since the spring of 1902, and this summer Mr. Allan Grant and Mr. William Fraser have been continuously in the service of the Lake Survey. In June Mr. Young was appointed to a post in the South African College, and his place on the staff was taken by Mr. J. H. M. Wedderburn, M.A., F.R.S.E. During the present summer (1903) the staff numbers about fifteen in all.

[2] *Geographical Journal*, vol. xv. p. 311.

taken by the staff on the maps, because of their being too close together. The intervals between the contour-lines of depth are tinted with deepening shades of blue, the darkest shades indicating the greatest depths. The orographical relief of the loch-basins has also been shown by contour-lines tinted with shades of brown, the darkening brown indicating the elevations. Longitudinal and cross sections of the depths have been drawn for each loch. On these sections the black line of varying thickness along the top represents the true vertical relief drawn to scale, while the coloured extensions in outline represent the vertical scale five times exaggerated, in order to show the relative depth with greater effect.

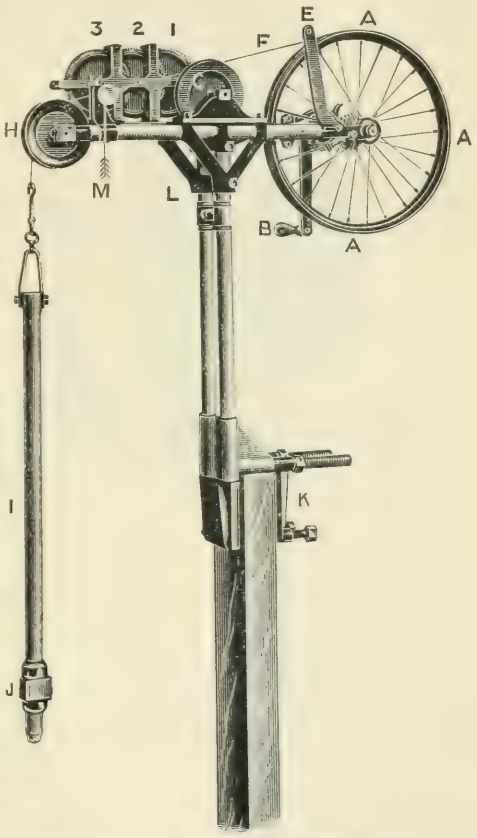


FIG. 4.—THE F. P. PULLAR SOUNDING-MACHINE.

The maps have been prepared under the direct superintendence of Mr. J. G. Bartholomew, F.R.S.E., who has taken great interest in the work, and has suggested lines of useful investigation. When the results of each river-basin are published, the tracings of the 6-inch maps above referred to, with the soundings on them, will be placed in the hands of the Director-General of the Ordnance Survey for preservation and future reference.

The late Sir Robert Menzies, the Marquis of Breadalbane, Sir John Stirling Maxwell, Donald Cameron, Esq. of Lochiel, Charles Murray, Esq., M.P., of Lochcarron, Lord Lovat, Sir John Ramsden, Sir Kenneth MacKenzie, H. C. Ross, Esq., Lord Zetland, and many other Highland proprietors, have taken great interest in the work of the survey. They have materially assisted, by the loan of boats and in other ways, in the progress of the survey ; indeed, without their aid the amount of work reported above could not have been carried through.[1]

[1] Proprietors and others interested in the work of the Lake Survey, and desirous of possessing for their own use 6-inch maps of any of the lochs surveyed, with the soundings and contour-lines of depth laid down in position, can be supplied with copies on payment of the cost of the maps and of the office labour involved in transferring the data. Application should be made to Mr. James Chumley, Secretary of the Lake Survey, *Challenger* Office, 45 Frederick Street, Edinburgh.

A limnograph constructed after the designs of M. Ed. Sarasin, of Geneva, has been erected in the grounds of the St. Benedict's monastery at Fort Augustus, by the kind permission of the Lord Abbot, and is under the charge of Mr. E. M. Wedderburn. Up to the time of writing, Mr. Wedderburn reports that since June 18 the instrument has been continuously recording the rise and fall in the waters of Loch Ness. He has been able to recognise uninodal, binodal, quadrinodal, as well as transverse seiches. Several observations have been made at various

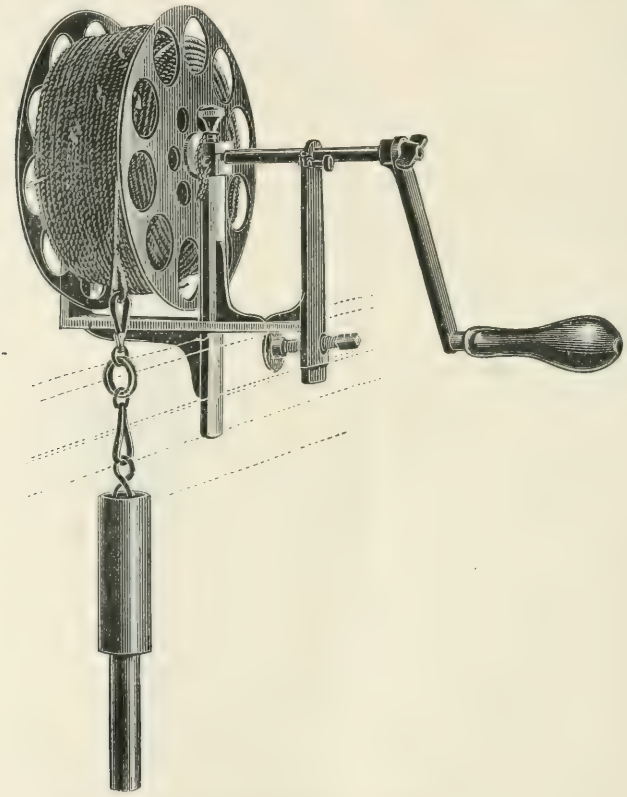


FIG. 5.—SMALL SOUNDING-MACHINE FOR USE IN SMALL AND SHALLOW LOCHS.

points on the shore by means of the plemyrameter, and it is hoped in this way to determine the position of the nodes.

Under the direction of Prof. Callendar, F.R.S., and Mr. Horace Darwin, F.R.S., instruments have been constructed and are being erected at Fort Augustus by Mr. E. R. Watson, to carry out—

(*a*) Observations on the *daily variations of temperature* of the waters by means of a series of platinum resistance thermometers (and Callendar's bolometers), with a view to obtaining, among other things—

(1) A measure of the amount of energy passing per day across unit area of the lake's surface.

(2) Some knowledge of the mechanism by which the water, especially in the deeper layers, is heated up and cooled off.

(*b*) Observations on the rate of leak of an electrically charged body on insulating supports in a vessel sunk to different depths, to ascertain—

(1) If water absorbs such radiations as effect the ionisation of gases.

(2) If the deep waters are themselves radio-active.

(*c*) Observations on the limiting depth for visibility of a painted disc, and the relation between this depth and the zenith distance of the sun, the amount of organisms and of inorganic matter in the water, the temperature of the water, etc.

A number of biologists are now stationed at Fort Augustus, carrying out observations on the planktonic and benthonic organisms in the waters of Loch Ness, at the same time and place as the above-mentioned physical observations. It is thought that some insight may in this way be obtained into the interpretation of the varying physical conditions and the habits of the organisms.

Arrangements have been made for the publication of the bathymetrical maps and the other observations of the Lake Survey staff in the *Geographical Journal*, the present communication being the first of the new series. It deals with a number of the lochs towards the headwaters of the main branches of the Tay basin. In addition to the maps, the paper is illustrated by photographs taken by the members of the staff and others.[1] It is hoped that the whole will, when completed, form a worthy memorial of the late Mr. F. P. Pullar, F.R.S.E.

Part III.—Lochs of the Tay Basin.

Extent of the Tay Basin.—The whole area of the drainage basin of the Tay, including the estuary as far as a line joining Tents Muir Point with Monifieth, as measured with the planimeter on the 1-inch Ordnance Survey maps, is 2509·73 square miles.[2] Considerably more than one-fourth of this area drains directly into fresh-water lochs, of which there are seventy, including some of the largest in Scotland—Lochs Tay and Ericht, for instance, being over 14 miles in length, while eight of them exceed 2 miles in length.

The river-systems, which arise in the most mountainous and magnificent regions of Scotland, may be divided into four principal branches, viz. the Garry branch (the most northerly), the Tummel branch, the Tay branch, and the Earn branch (the most southerly).

[1] Sir John Murray would be greatly indebted to amateur photographers for copies of any photographs of the Scottish fresh-water lochs, with a view to their reproduction in the publications of the survey. Any selected for this purpose will be duly acknowledged. The copies of the photographs may be forwarded to Mr. James Chumley, Secretary of the Lake Survey, *Challenger* Office, 45 Frederick Street, Edinburgh.

[2] Geikie (*An Elementary Geography of the British Islands*, London, 1888, p. 86) gives the drainage basin of the Tay as 2250 square miles, and Lawson (*The Geography of River Systems*, London, N.D., p. 6) as 2400 [square] miles. According to Geikie, the Tay pours a larger volume of water into the sea than any other British river, and its drainage area is the largest in Scotland, and seventh in point of size in the British Islands, being exceeded by that of the Shannon in Ireland, the Thames, Severn, Ouse, Trent, and Great Ouse in England.

(1) The Garry branch rises on the flanks of Beinn Mholach, Beinn Bhoidheach, and Carn Beag an Laoigh, flowing by various streams into Loch Garry, thence by the river Garry into the river Tummel at Faskally, to the north-west of Pitlochry, receiving the waters of the Erochy at Struan, and those of the Tilt at Blair Atholl.

(2) The Tummel branch rises in the Black Mount, the westernmost of the sources of the Tay river-systems, flowing by the river Bà into Loch Buidhe, Lochan na Stainge, and Loch Bà, which receives the outflow from Lochan na h-Achlaise, thence flowing into Loch Laidon, thence into Loch Eigheach—an expansion of the river Gaur—receiving the waters from Lochan Sròn Smeur, and then flowing into Loch Rannoch, which receives the outflow from Loch Ericht, flowing finally

FIG. 6.—INDEX MAP OF THE TAY BASIN, BY J. G. BARTHOLOMEW, F.R.G.S.

into Loch Tummel, thence by the river Tummel into the river Tay at Logierait.

(3) The Tay branch rises on the flanks of Ben Lui (Beinn Laoigh), and flows by the river Fillan into Loch Dochart and Loch Iubhair, thence by the river Dochart into Loch Tay, being joined by the river Lochay at Killin just before entering Loch Tay; the outflow from Loch Tay is carried into the estuary of the Tay by the river Tay, which is joined shortly after leaving Loch Tay by the river Lyon, bearing the outflow from Loch Lyon, and further on (at Logierait) by the river Tummel, bearing the outflow from the Garry and Tummel branches, still further on (at Dunkeld) by the river Bran, bearing the outflow from Loch Freuchie, still further on (at Cargill) by the river Isla, and still further on, shortly before reaching Perth, by the river Almond.

(4) The Earn branch takes its rise at the heads of Glen Ogle and Gleann Ceann Droma, the two streams flowing into the west end of Loch Earn, which receives also the waters of the Ample burn, Beich burn, the Vorlich, the Tarken, and other smaller streams; the outflow from Loch Earn passes at St. Fillans into the river Earn, which receives the waters of the Ruchill and Lednock near Comrie, those of the Turret bearing the outflow from Loch Turret, near Crieff, and other smaller streams as it flows eastward to join the Tay at the head of the estuary.

In this and the next succeeding paper it is proposed to deal with the results obtained by the Lake Survey in the lochs of the Tay basin. The bathymetrical results will be given in detail in the first instance, and in the last paper on the Tay basin lochs the general biological and physical results will be given, together with a description of the geological character of the upper parts of the basin by Dr. John Horne, F.R.S., of the Scottish Geological Survey.

Maps and Illustrations.

The maps illustrating this paper are reduced from the 6-inch Ordnance Survey charts, and are published by permission of the Controller of H.M. Stationery Office.

Plate I. shows Loch Bà, Lochan na h-Achlaise, Lochan na Stainge, and Loch Buidhe, the contour-lines of depth being drawn in at 10 and 20 feet.

Plate II. shows Loch Laidon with Dubh Lochan, the contour-lines of depth being drawn in at 25, 50, 75, 100, and 125 feet.

Plate III. shows Lochan Sròn Smeur and Loch Eigheach, the contour-lines of depth being drawn in at 10 and 20 feet.

Plate IV. shows Loch Rannoch, the contour-lines of depth being drawn in at 50, 100, 200, 300, and 400 feet.

Plate V. shows Lochs Dochart and Iubhair, the contour-lines of depth being drawn in at 25 and 50 feet.

Plate VI. shows Loch Lyon, the contour-lines of depth being drawn in at 25, 50, 75, and 100 feet.

Plate VII. shows Loch Earn, the contour-lines of depth being drawn in at 50, 100, 200, and 250 feet.

In addition to the maps, there are fourteen woodcuts in the text; eight illustrating the character of the scenery around the lochs, another showing the Tay basin on a small scale, intended to serve as an index map, two others giving photographs of Sir John Murray and the late Mr. Fred. Pullar, taken during their last sounding trip together, another giving a photograph of bronze tablet in memorial to the late Mr. Pullar, another showing the F. P. Pullar sounding-machine, and another showing new small sounding-machine for use in surveying small and shallow lochs.

1. *Lochs Ericht and Garry.*

These two lochs were sounded by Sir John Murray and the late

Mr. Fred. Pullar in the spring of 1900, and the results were published in the *Geographical Journal* in March 1901.[1]

2. *Rannoch Moor Lochs.*

No coach road in Britain probably passes through more magnificent scenery than that between the Bridge of Orchy and Ballachulish. About half-way between Inveroran Hotel and King's House Hotel, the river Bà crosses the road, and to the west lies Corrie Bà, the sanctuary of the Black Mount forest, where no shot is ever fired, and consequently this splendid corrie is the home of the deer, the golden eagle, the fox, and other wild animals. Here also is the most westerly sources of the

FIG. 7.—MOOR OF RANNOCH, SHOWING LOCH BUIDHE AND LOCHAN NA STAINGE.
(*Photo by Sir John Murray.*)

rivers of the Tay basin. In rainy weather a large amount of water passes down the river Bà and other streams into the Moor of Rannoch, and about a mile or two to the eastward of the road a large extent of the moor is flooded, and presents the appearance of a vast lake. In drier weather there are distinct basins, which have received the names of Loch Buidhe, Lochan na Stainge, Lochan na h-Achlaise, and Loch Bà (or A-baw), all of them situated in drift and encumbered with rocks and small islands; they are all shallow. These lochs all contain trout, and have boats on them; they belong to the Marquis of Breadalbane, and are strictly preserved. On Eilean Molach in Loch Bà the heron still breeds in large numbers, and formerly the osprey used to breed in

[1] *Geographical Journal*, vol. xvii. p. 289.

the same place. In making the survey of these lochs, the staff were much obliged to Mr. M'Intyre, head stalker to the Marquis of Breadalbane.

Loch Buidhe.[1]—Loch Buidhe (or Buie) is very shallow, and in places covered with weeds, though its surface is practically free from islands. It is somewhat quadrangular, though irregular, in outline, the maximum diameter (or length) from east to west being about one-third of a mile, and the maximum breadth from north to south about a quarter of a mile, the mean breadth being about one-sixth of a mile. Its waters cover an area of about 35 acres, or one-nineteenth of a square mile, and it drains an area 222 times greater, or over 11 square miles. It is deepest towards the eastern shore, where the maximum depth (3 feet) was observed in several places, shoaling towards the western shore, off which the weeds are most abundant; the volume of water contained in it is estimated at 2,265,000 cubic feet. It was surveyed on April 15, 1902, by Messrs. Parsons, Clark, and M'Intosh, about forty soundings being recorded. The surface of the water was determined by the Ordnance Survey officers in 1897 as being 981 feet above sea-level. The temperature of the surface water at 7 P.M. on April 15, 1902, was 48° Fahr.

Lochan na Stainge.[2]—Lochan na Stainge (or na-Sting) is extremely irregular in outline, and includes three comparatively large islands as well as a number of small ones. Its length from north to south is over half a mile, the maximum breadth being two-fifths of a mile, and the mean breadth about one-seventh of a mile. Its waters cover an area of over 51 acres, or rather more than one-twelfth of a square mile, and it drains directly about two-thirds of a square mile, but, since it receives the outflow from Loch Buidhe, its total drainage area is nearly 12 square miles, or 147 times the area of the loch. The loch is divided into two portions by a barrier at the central constriction, on which there is only 1 foot of water, the maximum depth observed in the northern portion (between the large island and the northern shore) being 8 feet, while the maximum depth of the loch (14 feet) was found in the southern portion immediately to the south of the barrier referred to. The volume of water contained in the loch is estimated at 11,407,000 cubic feet, and the mean depth at 5 feet. The loch is on the whole shallow, nearly 99 per cent. of its floor being covered by less than 10 feet of water. It was surveyed on April 19, 1902, by Sir John Murray and Dr. Johnston, fifty-five soundings being recorded. The level of the loch was not determined by levelling, but on the new edition of the Ordnance Survey map (1897) there is a spot-level of 972 feet on the southern shore near the inflow, and another of 968 feet on the northern shore at the outflow, so that the surface of the water is probably about 970 feet above the sea. The drift-marks around the loch showed that it sometimes rises 5 feet higher than on the date surveyed, and during floods the whole valley looks like one loch, with knolls projecting above the water. The temperature of the surface water at 10.30 A.M. on April 19, 1902, near the boathouse, was 43°, and on returning to the same place at 12.30

[1] = Yellow Loch.

[2] = Loch of the Stank or Fold.

(noon) it had risen to 46·4°; in the main basin, near the centre, the surface temperature was 42·6°, while the temperature of the air was 49°.

Lochan na h-Achlaise.[1]—Lochan na h-Achlaise (or na-Hachlich) is irregular in form, the outline being somewhat triangular or heart-shaped, with the apex pointing south. It includes many larger and smaller islands, and the bottom in the shallower places is covered by stones and boulders. The length from north to south is over four-fifths of a mile, while the maximum breadth from east to west is about three-quarters of a mile, the mean breadth being over one-third of a mile. Its waters cover an area of about 183 acres, or nearly three-tenths of a square

FIG. 8.—LOCHAN NA H-ACHLAISE.
(*Photo by R. M. Clark, B.Sc.*)

mile, and it drains an area of over one square mile, or nearly four times the area of the loch. The north-western portion of the loch is shallow, the deeper water being found in the southern and eastern portions. The 10-feet basin is a continuous area, extending from near the southern shore in a northerly and then north-easterly direction to near the north-eastern shore, excluding the islands lying off the eastern shore, and is nearly three-quarters of a mile in length. The 10-feet basin includes two 20-feet basins, the more southerly being the larger and deeper, the maximum depth of the loch (28 feet) having been found towards the north-eastern end of this basin, and comparatively close to the eastern shore. The volume of water contained in the loch is estimated

[1] = Loch in the Hollow.

at 76,236,000 cubic feet, and the mean depth at 9½ feet. The loch is on the whole comparatively shallow, about 63 per cent. of the bottom being covered by less than 10 feet of water, while only 9 per cent. of the bottom is covered by over 20 feet of water. The loch was surveyed on April 16, 1902, by Messrs. Parsons, Clark, and M'Intosh, over one hundred soundings being recorded. The surface of the water was found to be 962 feet above sea-level by the officers of the Ordnance Survey in 1897. The temperature of the surface water at 6 P.M. on April 16, 1902, was 45·2°.

Loch Bà.[1]—Loch Bà (or A-baw) is extremely irregular in outline, studded with large and small islands, and with many rocks and boulders. Its length from south-west to north-east in a straight line is over 2 miles, and following the axis of deep water about 2½ miles. Its maximum breadth in the southern portion from east to west is over a mile, and the mean breadth is nearly half a mile. Its waters cover an area of about 585 acres, or nine-tenths of a square mile, and it drains directly an area of 4½ square miles, but, since it receives the outflow from Loch Buidhe, Lochan na Stainge, and Lochan na h-Achlaise, its total drainage area is nearly 17½ square miles, or nineteen times the area of the loch.

The bottom of Loch Bà is very irregular. The deepest water occurs in the northern portion between the islands of Eilean Molach and Eilean na h-Iolaire, where there is a small basin less than a quarter of a mile in length and over 20 feet in depth, the maximum depth of 30 feet having been observed about one-sixth of a mile to the north of the northern point of Eilean Molach. An isolated sounding of 20 feet was taken close to the western shore of the southern portion of Eilean Molach. There are three irregular basins with depths exceeding 10 feet: the central one, enclosing the 20-feet basin, and extending on both sides of Eilean Molach and to the west and north of Eilean na h-Iolaire, is nearly three-quarters of a mile in length and over a quarter of a mile in breadth; the southern one, occupying the wide south-eastern portion of the loch, is nearly half a mile in maximum diameter; and the third, situated in the north-eastern extension of the loch, is nearly half a mile in length and nearly a quarter of a mile in breadth. The volume of water contained in the loch is estimated at 206,497,000 cubic feet, and the mean depth at 8 feet, being 27 per cent. of the maximum depth. The length of the loch is 378 times the maximum depth and 1402 times the mean depth. Over 70 per cent. of the floor of the loch is covered by less than 10 feet of water, and only 1½ per cent. by more than 20 feet of water. The loch was surveyed on April 17 and 18, 1902, by Sir John Murray and Dr. Johnston, over three hundred soundings having been taken. The level of the loch was determined by the Ordnance Survey officers in 1897 as being 957 feet above sea-level. The temperature of the surface water near the boathouse, when commencing the survey at 2.45 P.M. on April 17, was 50·8° Fahr., but later, out in the open water, the surface temperature was 44·2° Fahr.; on the 18th at noon the

[1] = Cow Loch.

surface temperature near the shore was 50·0° Fahr. (the air-temperature at the time being 50·4° Fahr.), while in the bay to the north of the boathouse the temperature was 46·0° Fahr.

Lochan Beinn Caorach [1] and some other small basins of water in this region were without boats and could not be sounded; they were evidently all quite shallow and of the same character as Loch Buidhe.

Loch Laidon.[2]—Loch Laidon (or Lydoch, or Luydan) lies partly in

FIG. 9.—HERONS' NESTS ON EILEAN MOLACH IN LOCH BÀ

(Photo by T. N. Johnston, M.B., C.M., F.R.S.E.)

Perthshire and partly in Argyllshire, the boundary running along the centre of the western arm and for a certain distance up the main loch. It is one of the best trouting lochs in the district, or perhaps in Scotland. It is about 5⅓ miles in length from north-east to south-west, but it sends out an arm towards the west, which is over 1½ miles in length, and a line following the axis of the loch from the north-east end to the extremity of the western arm would be over 6 miles in length. Its

[1] = Loch of the Sheep Hill. [2] = Loch of the Slopes.

maximum breadth is nearly three-quarters of a mile, and the mean breadth about one-third of a mile, or 6·4 per cent. of the length. Its waters cover an area of about 1149 acres, or over $1\frac{3}{4}$ square miles, and it drains directly an area of $30\frac{1}{4}$ square miles; but, since it receives the outflow from Lochs Bà, Achlaise, Stainge, and Buidhe, its total drainage area is over $47\frac{1}{2}$ square miles, or $26\frac{1}{2}$ times the area of the loch. Nearly five hundred soundings were taken in the loch, and the maximum depth observed was 128 feet, the mean depth being 35 feet, or $27\frac{1}{2}$ per cent. of the maximum depth. The length of the loch is 219 times the maximum depth, and 795 times the mean depth. The volume of water contained in the loch is estimated at 1,761,733,000 cubic feet. The western extension and the southern end of Loch Laidon are filled with boulders and islets, and are like Loch Bà in character, but the main basin is of comparatively simple form, though with minor undulations of the lake-floor, the deepest water occupying the centre of the loch, where there is a basin three-quarters of a mile in length and over 100 feet in depth, the maximum depth of 128 feet having been observed about $2\frac{3}{4}$ miles from the south-west end and $2\frac{1}{2}$ miles from the north-east end. Separated from this main 100-feet basin by shallower water, there is a sounding of 104 feet a short distance to the south-west, and half a mile further south there is an isolated sounding of 100 feet; there is also an isolated sounding of 100 feet a quarter of a mile to the north-east of the main basin. The principal 50-feet basin extends from less than a mile from the south-west end to less than $1\frac{1}{2}$ miles from the north-east end, and is nearly 3 miles in length. Separated from this larger basin by an interval of a quarter of a mile is a smaller one, about one-third of a mile in length, situated in the north-eastern part of the loch, and nearly midway between them is an isolated sounding of 50 feet. The western arm of Loch Laidon is shallow and filled with rocks and boulders, the greatest depth observed being 17 feet in three different places. Of the entire lake-floor, 53 per cent. is covered by less than 25 feet of water, 21 per cent. is covered by water between 25 and 50 feet in depth, 22 per cent. by water between 50 and 100 feet in depth, and 4 per cent. by water exceeding 100 feet in depth. Loch Laidon was surveyed on April 9 to 25, 1902, by Sir John Murray, Dr. Johnston, Messrs. Parsons, Clark, and M'Intosh, and the surface of the loch was found by levelling to be 923·9 feet above sea-level. When surveyed by the Ordnance Survey officers on July 28, 1860, the level of the loch was 924·6 feet above the sea. At the north-eastern end of Loch Laidon is a small basin called Dubh Lochan,[1] which was found by levelling on April 14, 1902, to be 2 feet higher than Loch Laidon, and should therefore, strictly speaking, be looked upon as a distinct lake, but in the foregoing description the two lakes have been regarded as one. Many temperature observations were taken in Loch Laidon on April 9, 10, 14, 15, and 25, the surface readings varying from 38·8° at 5 p.m. on the 9th to 48·2° at the head of the loch at 1 P.M. on the 10th—a range of 9·6° in the temperature of the water, while the range in the air-temperature

[1] = Black Lochan.

during the same period was only 5° (from 45·2° to 50·2°). Two serial temperature observations were taken in the centre of the loch, the first at 5 P.M. on April 9, when the readings were identical (39·8°) at the surface and at depths of 5 and 25 feet, the second at 5.20 P.M. on the 10th, when the surface readings were 39·8° and 41°, that at 5 feet 39·7°, and that at 20 feet 39·4°. The surface temperature in Dubh Lochan on April 14 was 43·9°.

The western arm of Loch Laidon receives the waters from a small loch (Lochan Gaineamhach[1]) lying about 2 miles to the west. This

FIG. 10.—LOCH LAIDON.
(*Photo by Miss Margaret Murray.*)

loch, and the neighbouring one to the north, were visited on May 20, 1903, but, as there were no boats on them, they were not sounded. They were found to be of the same general character as the other lochs of Rannoch Moor—shallow, with stony shores, containing boulders and islets, some of the latter with small trees on them. In Lochan Gaineamhach, weeds were seen only in some very small bays, but in the other lochan weeds were seen in several places, with a little open water in the eastern half.

To the north of the north-eastern end of Loch Laidon lies the little Lochan a' Chlaidheimh,[2] where three counties (Perthshire, Argyllshire, and Inverness-shire) meet. This lochan was visited on May 14, 1902, but was not sounded, as there was no boat on it. It is

[1] = Loch of Sandy Beaches. [2] = Loch of the Sword.

evidently very shallow in all parts, full of rocks and boulders, a rock showing above water even in the very centre, and all along the shores rocks are numerous, extending in lines out from the shore. A couple of miles to the east of Lochan a' Chlaidheimh lies Lochan Sròn Smeur, next to be dealt with, on which there was a boat.

Lochan Sròn Smeur.[1]—Lochan Sròn Smeur (or Sròn-Smear) is situated a little to the east of the road running from Rannoch to Loch Ossian, and is said to contain small black trout, but is strictly preserved. It is over half a mile in length, less than a quarter of a mile in maximum breadth, the mean breadth being one-seventh of a mile, or 25 per cent. of the length. Its waters cover an area of over 50 acres (or about one-twelfth of a square mile), and it drains an area of nearly 2 square miles, nearly twenty-four times the area of the loch. It was surveyed on May 12, 1902, by Sir John Murray and Mr. James Murray, who took about seventy soundings, the maximum depth observed being 33 feet. The volume of water contained in the lake is estimated at 22,592,000 cubic feet, and the mean depth at 10·3 feet, or 31 per cent. of the maximum depth. The loch is of simple conformation, the western half being comparatively shallow, while the deeper water occurs in the eastern half, the maximum depth having been found about one-eighth of a mile from the eastern end. The 10-feet basin approaches quite close to the eastern shore, and is about one-third of a mile in length, enclosing the 20-feet basin, which is about one-fifth of a mile in length. About 61 per cent. of the lake-floor is covered by less than 10 feet of water, while about 12 per cent. is covered by over 20 feet of water. No bench-marks were found near the loch, but a little distance up the river which feeds it there is a spot-level of 1134 feet. There was little evidence of much rise and fall in the level of the water, the range possibly not exceeding 2 feet. The temperature of the surface water varied from 47·4° to 50·5°, a range of 3·1°, the higher readings being taken in shallow water near shore. Readings at 10 feet and at 20 feet near the centre of the loch gave 48° in each case, the surface temperature at the same time being 47·6°.

Less than a mile to the east of Lochan Sròn Smeur is Lochan Lòin nan Donnlaich[2] (or Lochan Lòin nan Dubhach, or Loch-an-Londonich), said to contain large trout. When visited, many rocks and boulders were observed showing above the water, and grass filled the bay at the outlet.

Loch Eigheach.[3]—Loch Eigheach (or Eaigh), about 3 miles from where the river Gaur passes its waters into Loch Rannoch, is an expansion, or rather three expansions, of the river Gaur, the two western expansions lying on a higher level than the eastern one, and hence strong currents run in an easterly direction. In high floods the whole area is practically submerged. A large part of the loch is covered by reeds, and the bottom is very weedy. The entire loch is nearly nine-tenths of a mile in length, with a maximum breadth of less than a quarter of a mile, the

[1] = Loch of the Marrow Point. [2] = Loch of the Macdonald's Field.
[3] = Loch of the Cry (?).

mean breadth being one-tenth of a mile. Its waters cover an area of about 59½ acres, or less than one-tenth of a square mile, and it drains directly an area of nearly 14 square miles, but since it receives the outflow from Lochan Sròn Smeur and from Lochs Laidon and Bà, etc., its total drainage area is nearly 63½ square miles, or 705 times the area of the loch. The loch was surveyed by Dr. Johnston on April 21, 1902, about eighty soundings being recorded, the maximum depth observed being 28 feet. The surface of the eastern expansion was found by levelling to be 818·2 feet above sea-level, and the water apparently rises about 3½ feet above its level on the date surveyed. The volume of water contained in the loch is estimated at 15,794,000 cubic

FIG. 11.—LOCHAN SRÒN SMEUR.
(Photo by H. C. Lamb.)

feet, and the mean depth at 6 feet, or 22 per cent. of the maximum depth. The eastern expansion is the deepest, the maximum depth of 28 feet having been found to the west of the island near the east end of this expansion; the north-western expansion has a maximum depth of 7 feet observed not far from the outlet, but the majority of the soundings run from 2 to 5 feet; the south-western expansion is the shallowest, with a maximum depth of 3 feet to the west of the central large island (Eilean na Coille), the bottom to the east and south of that island being covered by only 1 foot of water. Over 90 per cent. of the entire lake-floor is covered by less than 10 feet of water, and less than 2 per cent. by over 20 feet of water. The surface temperature in the eastern expansion at 11 A.M. on April 21, 1902, was 44·2°, the air-temperature at the time being 49·5°.

3. *Loch Rannoch.*[1]

Loch Rannoch, one of the larger and more important of the lochs in the Tay basin, was the headquarters of the Lake Survey for nearly four months, from March 20 to July 10, 1902, and during that period a great many soundings, as well as observations on the temperature of the water, on the biology, and on the rise and fall of the surface of the loch, were taken, all the members of the staff taking part in the work. The lake trends in an east-and-west direction, and is a lovely sheet of water, the hills on both sides, and the woods clothing its shores in many places, adding beauty to the scene. The famous Black Wood of Rannoch on the south side is of great antiquity. The loch contains many small trout, and is famed for large *Salmo ferox*. It is nearly $9\frac{3}{4}$ miles in length, considerably over a mile in maximum breadth, the mean breadth being about three-quarters of a mile, or about 8 per cent. of the length. Its waters cover an area of over 4700 acres, or nearly $7\frac{1}{2}$ square miles, and it drains directly an area of about 130 square miles, but, since it receives the outflow from Loch Ericht, Loch Eigheach, Loch Laidon, Loch Bà, etc., its total drainage area is about $243\frac{1}{2}$ square miles, or 33 times the area of the loch.

Over eight hundred soundings were taken in Loch Rannoch, the maximum depth observed being 440 feet, or 20 feet deeper than the maximum depth recorded by Mr. Grant-Wilson during his survey in the year 1888, when he took about 320 soundings. The volume of water contained in the loch is estimated at about 34,387,131,000 cubic feet, or less than a quarter of a cubic mile, and the mean depth at $167\frac{1}{2}$ feet, or 38 per cent. of the maximum depth. The length of the loch is 116 times the maximum depth, and 306 times the mean depth. The loch is widest and deepest in the eastern half, narrowing and shallowing towards the west on approaching the island Eilean nam Faoileag, then deepening again to the west of that island. It consists of one large main basin, with two subsidiary small basins over 50 feet in depth towards the west end, separated from the main basin by the shallow water in the neighbourhood of Eilean nam Faoileag. The larger of the two subsidiary basins is about three-quarters of a mile in length, stretching from south of the island An t-Eilean Fearna, at the entrance of the river Ericht, towards the west end of the loch, and the maximum depth recorded in it was 84 feet; the smaller basin lies between the two islands mentioned and towards the northern shore, soundings of 52 and 54 feet having been obtained therein. The main 50-feet basin is about $7\frac{3}{4}$ miles in length, occupying the great body of the loch east of Eilean nam Faoileag, and covering an area exceeding 5 square miles. The 100-feet basin is nearly 7 miles in length, extending from between the mouths of the Killichonan Burn and the Allt Camghouran towards the east end of the loch. The 200-feet basin is 6 miles in length, stretching from within a quarter of a mile from the east end to opposite the house Talla Bheith on the northern shore. The main 300-feet basin is nearly 4 miles in length, stretching from less

[1] = Loch of the Ferns.

than half a mile from the east end to opposite Dall on the southern shore, and separated from it by an interval of a quarter of a mile is an isolated sounding of 304 feet. Within the 300-feet basin the bottom sinks in three places along the central axis of the loch below the 400-feet line. The easternmost of these three 400-feet basins is the largest and deepest, situated about $1\frac{1}{4}$ miles from the east end, about two-thirds of a mile in length, and enclosing the maximum depth of the loch (440

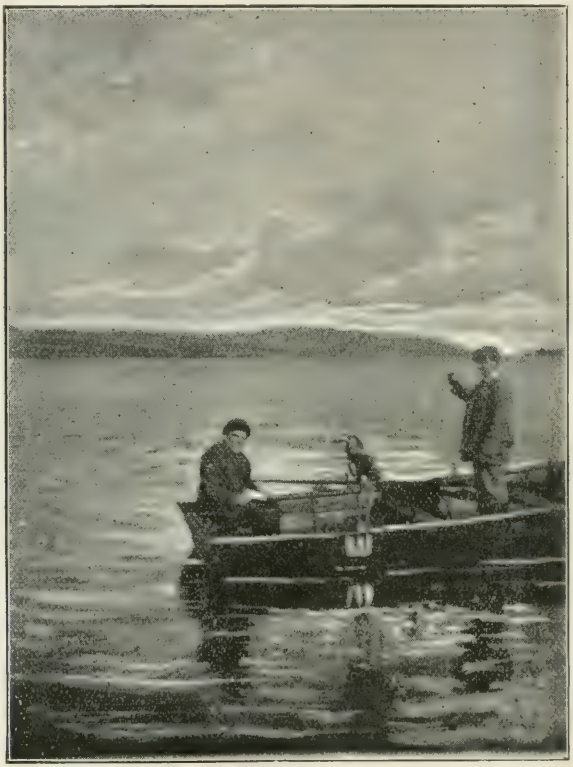


FIG. 12.—LOCH RANNOCH.

(*Photo by Miss M'Pherson.*)

feet); a short distance to the west (opposite Craiganour) is a second small basin based upon a sounding of 404 feet; and three-quarters of a mile farther west is the third basin, with a maximum depth of 421 feet. The area of the lake-floor covered by less than 50 feet of water is about 1200 acres (nearly 2 square miles), or 25 per cent. of the total area, while the area between the 50-feet and 100-feet lines is about 750 acres, or 16 per cent., showing a relatively rapid descent beyond the 50-feet line. The area between the 100- and 200-feet lines is about 877 acres, or nearly 19 per cent. of the entire area. The area between the 200- and 300-feet lines is about 950 acres, or over 20 per cent.

The area between the 300- and 400-feet lines is about 875 acres, or $18\frac{1}{2}$ per cent., and that over 400 feet about 65 acres, or nearly $1\frac{1}{2}$ per cent. of the total area of the loch.

On commencing the survey of Loch Rannoch, the height of the surface above sea-level was determined from Ordnance Survey bench-marks as 668 feet; the level of the loch fluctuated during the progress of the survey, but the soundings have all been reduced to this datum. The officers of the Ordnance Survey on July 19, 1860, found the level of the loch to be 667·5 feet above the sea.

Very many temperature observations were taken between March 20 and July 10, 1902. The surface temperatures need not be discussed in detail; the lowest reading recorded was 37·9° on March 28, and the highest 59·8° on June 23, showing a range of 22° in the temperature of the surface water during the period of three months. An interesting series of hourly observations on the temperature of the air and of the surface water at the pier at Rannoch Lodge was taken on June 9. One thermometer was immersed in 3 feet of water outside the pier, and another in 1 foot of water inside the pier, and they were read simultaneously with an air-thermometer at intervals of one hour from 9 A.M. to 10 P.M. The temperature of the air rose gradually, though irregularly, from 48° at 11 A.M. to a maximum of 53° at 4 P.M., falling gradually again to 44·5° at 9 P.M., and 45° at 10 P.M. The thermometer in 3 feet of water showed a gradual rise in the temperature from 51·9° at 9 A.M. to 53° at 11 A.M., then a slight fall at noon (52·7°) and at 1 P.M. (52·5°), the maximum (53·6°) being recorded at 2 P.M., falling to 52·9° at 4 P.M., rising to 53·3° at 5 P.M., falling gradually to 52·1° at 8 P.M., then rising to 52·8° at 9 P.M., and 53° at 10 P.M. The thermometer in 1 foot of water showed a gradual rise in the temperature from 51·4° at 9 A.M. to the maximum of 53·6° at 2 P.M., whence it fell gradually to 51·5° at 9 P.M., the reading at 10 P.M. being 52°. The maximum temperature of the water was recorded in each case at 2 P.M., while the maximum temperature of the air was recorded at 4 P.M., and the temperature of the air was always lower than that of the water, except when the air was at its maximum (53° at 4 P.M.), the thermometer in 3 feet of water then reading 52·9°, while that in 1 foot of water read 53·3°. The temperature recorded in 1 foot of water was lower than that recorded in 3 feet of water in the forenoon and late evening, but at noon and 1 P.M. it was higher, at 2 P.M. and 3 P.M. it was identical, and from 4 P.M. till 8 P.M. it was higher, the greatest difference recorded being 1·3° at 9 P.M. (52·8° at 3 feet, and 51·5° at 1 foot).

The temperatures taken beneath the surface have been collected together and arranged chronologically in the following table, which may be useful for future reference and comparison. The great majority of them were taken in the small 80-feet basin towards the west end of the loch, while one series was taken near the east end on April 3, and three series were taken towards the middle of the loch, opposite Craiganour, on May 1, 2, and 23. The table shows well the heating up of the water with the advance of summer. The readings taken near the west end in March are all below 39° Fahr.—that is, below the maximum

SERIAL TEMPERATURES TAKEN IN LOCH RANNOCH.

Depth. Feet.	22/3/02. West end.	26/3/02. 2.30 p.m. West end.	26/3/02. 3.30 p.m. West end.	28/3/02. 4 p.m. Five miles from West end.	2/4/02. 3.30 p.m. West end.	3/4/02. 4.15 p.m. Three-quarters mile from Kinloch Rannoch.	8/4/02. 4.15 p.m. West end.	9/4/02. 11.35 a.m. West end.	9/4/02. 5 p.m. West end.	10/4/02. 7 a.m. West end.	21/4/02. 3.30 p.m. West end.	1/5/02. Afternoon. Opposite Craiganour.	2/5/02. Craiganour.	3/5/02. 6 p.m. West end.	23/5/02. 11 a.m. West end.	23/5/02. 4 p.m. Opposite Craiganour.	28/5/02. 7.15 p.m. West end.	6/6/02. West end.	7/6/02. 10 a.m. West end.	7/6/02. 8 p.m. West end.	21/6/02. 6.30 p.m. West end.
	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.
Surface	38·4	38·8	38·0	38·9	39·4	38·9	42·3	39·9	39·7	39·3	45·8	41·4	41·2	45·3	47·3	42·0	48·3	50·0	48·8	49·8	52·0
3	…	…	…	…	…	…	…	…	…	39·8	…	…	…	…	…	…	…	…	…	…	…
5	…	…	38·0	…	…	…	…	…	39·6	39·5	45·8	41·8	…	45·2	…	…	…	50·0	48·8	…	52·0
10	…	38·3	38·0	…	39·4	39·0	…	39·8	…	39·5	45·0	41·7	41·2	…	…	42·0	48·0	49·5	48·9	50·0	52·0
15	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	48·8	…	49·0	…
20	…	38·3	…	…	39·4	38·9	…	39·7	…	39·5	43·2	41·6	41·2	…	47·3	42·1	48·0	…	48·8	…	51·3
23	…	…	…	38·3	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
25	…	…	…	…	…	…	…	…	…	…	…	41·3	…	45·0	…	…	…	48·4	…	47·6	…
30	38·6	38·3	…	…	…	…	39·9	39·8	…	…	…	41·3	..	…	…	…	…	…	48·5	…	51·0
32	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	48·2	…	…
35	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	48·9	47·2	…	…
40	…	38·3	37·9	…	39·4	38·9	…	39·8	39·6	39·6	…	…	…	…	47·2	…	48·0	…	47·2	46·9	…
45	…	…	…	…	…	…	…	…	…	…	..	…	…	…	47·2	…	…	…	…	…	…
50	…	38·3	…	…	…	…	39·9	40·0	39·6	39·5	43·0	41·3	…	45·0	47·2	42·1	…	…	46·8	46·4	49·9
60	…	38·3	37·9	…	…	…	…	40·0	…	…	…	…	…	…	46·9	…	…	…	…	…	…
70	38·8	38·3	…	…	…	…	39·8	40·0	…	39·4	43·0	…	…	44·1	46·9	42·2	…	…	…	…	47·0
75	…	…	…	…	39·3	…	..	…	39·3	…	…	…	…	..	…	…	…	…	46·3	46·1	…
80	…	…	…	…	…	…	…	40·0	…	39·3	42·8	…	…	…	…	…	…	…	…	…	…
100	…	…	…	. .	…	38·9	…	…	…	…	…	40·3	40·8	…	…	41·9	…	…	…	…	…
200	…	…	…	…	…	38·9	…	…	…	…	…	40·0	40·2	…	…	…	…	…	…	…	…
300	…	…	…	…	…	…	…	…	…	…	…	40·0	…	…	…	…	…	…	…	…	…

density point, though surface temperatures exceeding 39°, and in one or two cases exceeding 40°, were recorded nearer the shore during the last days of March. On April 2 and subsequently, the temperature was above that of maximum density (39·1°), but the observations taken near the east end on April 3 showed that the temperature of the water from surface to bottom was just below maximum density point. The water in the small western basin had a temperature under 40° up to April 10, and was practically uniform from top to bottom, but on April 21 and subsequently the temperature rose, and there was a considerable range between the temperature of the upper and lower layers. The water in the main basin had a temperature of 40° at 200 and 300 feet on May 1; on May 2 the temperature was 40·2° at 200 feet; and on May 23 it was 41·9° at 100 feet. By the beginning of June the water near the surface had attained a temperature of 50°, and by June 21 that temperature extended down to 50 feet, the upper 10 feet having on that date a temperature of 52°.

4. *Loch Lyon.*

Loch Lyon lies at a high elevation at the head of Glen Lyon, amid grand and mountainous scenery, its waters being carried by the river Lyon into the river Tay a short distance above the mouth of Loch Tay; it contains both salmon and trout. It trends in a north-east and south-west direction, and is extremely simple both in outline and in the conformation of the bottom. It is of nearly uniform width, except for a cone of alluvium, brought down by the river, on the south-eastern shore. It is about $1\frac{3}{4}$ miles in length, with a maximum breadth of over a quarter of a mile, the mean breadth being over one-fifth of a mile, or 12 per cent. of the length. Its waters cover an area of about 236 acres, or over one-third of a square mile, and it drains an area of over $10\frac{1}{2}$ square miles, an area nearly twenty-nine times greater than that of the loch. Over one hundred soundings were taken in Loch Lyon, the maximum depth observed being 100 feet. The volume of water contained in the loch is estimated at about 460,750,000 cubic feet, and the mean depth at 45 feet, or 45 per cent. of the maximum depth. The length of the loch is 92 times the maximum depth, and 205 times the mean depth. As stated, the loch forms a simple basin, the bottom sinking gradually on all sides towards the deepest part, which is approximately centrally placed. The deep water, however, approaches much closer to the south-west end than to the north-east end, where the 25-feet line is distant about a quarter of a mile from the shore, probably through silting up of the lake-floor at that end. The 25-feet basin is nearly $1\frac{1}{2}$ miles in length, the 50-feet basin is about $1\frac{1}{3}$ miles in length, and the 75-feet basin is about $1\frac{1}{6}$ miles in length. The area of the lake-floor covered by less than 25 feet of water is about 92 acres, or 39 per cent. of the total area of the loch; the area between the 25- and 50-feet contour-lines is about 36 acres, or over 15 per cent.; the area between the 50- and 75-feet contours is about 55 acres, or over 23 per cent.; and the area over 75 feet in depth is about 53 acres, or less than 23 per cent. of the

entire area of the loch. The comparatively flat-bottomed character of the deep basin is indicated by the larger proportion of the bottom covered by water between 50 and 75 feet in depth, as compared with the proportion covered by water between 25 and 50 feet, the average slope being thus considerably steeper in depths of 25 to 50 feet than in depths of 50 to 75 feet; and this latter gentler slope is continued into the deeper water over 75 feet in depth, as shown by the nearly equal areas on both sides of the 75-feet line. The large proportion under 25

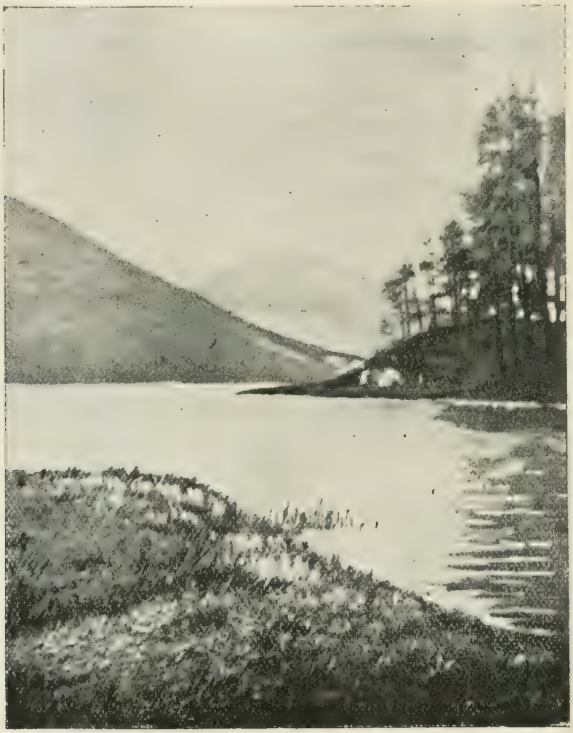


FIG. 13.—LOCH LYON.

(*Photo by Sir John Murray.*)

feet in depth is due to the considerable silted-up area towards the north-east end of the loch, already referred to. Loch Lyon was surveyed by Sir John Murray, Dr. Johnston, and Mr. Parsons on May 10, 1902. No bench-marks were to be seen along the shores, nor on the Ordnance Survey charts, but the height of the surface of the loch was estimated as being about 1050 feet above the sea. Lines of drift were observed 4 feet above the water, which, according to the keeper, was about its normal height at the time of the survey; the water rises suddenly and falls as quickly, and might fall perhaps a foot lower than on the date of the survey. Thus a range of about 5 feet in the level of the water is

indicated. The temperature of the surface water on May 10, 1902, when commencing the survey, about noon, was 48·7° at the edge of the bank at the north-east end (the temperature of the air at the time being 46·4°), and readings taken along the shore gave 50°, 51·8°, 52·5°, and 58°. In the afternoon, readings of 47·9° were taken in shallow water towards the northern shore, 48·9° near the south-west end, and 46·4° in the centre of the loch. These observations show a range of 11·6° in the temperature of the surface water throughout the day, viz. from 46·4° to 58°.

5. *Lochs Dochart and Iubhair.*

Loch Dochart.—Loch Dochart, situated at the foot of Ben More amid beautiful scenery, is the westernmost of the lochs belonging to the Tay branch of the Tay river-system, being evidently an expansion of the river Fillan, which forms the headwaters of this branch. It receives the drainage from a considerable tract of country, is very shallow, the bottom is very weedy, and there are many reeds, especially at the west end. Loch Dochart is nearly two-thirds of a mile in length, with a maximum breadth of nearly one-sixth of a mile, the mean breadth being over one-tenth of a mile, or 18 per cent. of the length. Its waters cover an area of about 46 acres, or nearly one-fourteenth of a square mile, and it drains an area of nearly 39 square miles, or 555 times the area of the loch. Nearly seventy soundings were taken in Loch Dochart, the maximum depth observed being 11 feet; but this depth is of very limited extent, only two isolated soundings being recorded near the west end of the loch, while by far the greater portion of the bottom is covered by less than 5 feet of water. The volume of water contained in the loch is estimated at 10,032,000 cubic feet, and the mean depth at 5 feet, or 46 per cent. of the maximum depth. The length of the loch is 298 times the maximum depth, and 652 times the mean depth. Loch Dochart was surveyed by Dr. Johnston and Mr. Parsons on April 28, 1902, and the level of the surface of the water was determined from Ordnance Survey bench-mark as being 513 feet above sea-level. The temperature of the surface water at 11.30 A.M. on that date was 50·1°, the temperature of the air at the same time being 49°.

Loch Iubhair.[1]—Loch Iubhair (or Nubhair) receives the outflow from Loch Dochart by a river considerably less than half a mile in length, so that they may almost be regarded as forming one lake. It affords fair trout-fishing, and the scenery round about is very beautiful. Loch Iubhair is about $1\frac{1}{3}$ miles in length, with a maximum breadth of about one-third of a mile, the mean breadth being nearly one-sixth of a mile, or 12 per cent. of the length. Its waters cover an area of about $135\frac{1}{2}$ acres, or over one-fifth of a square mile, and it drains directly an area of about $5\frac{3}{4}$ square miles; but, since it receives the outflow from Loch Dochart, its total drainage area is over $44\frac{1}{2}$ square miles, or 212 times the area of the loch. Over one hundred soundings were taken in Loch Iubhair, and the maximum depth observed was 65 feet. The volume of

[1] =Loch of the Yew-Trees.

water contained in the loch is estimated at 147,284,000 cubic feet, and the mean depth at 25 feet, or 38 per cent. of the maximum depth. The length of the loch is 110 times the maximum depth, and 286 times the mean depth. Loch Iubhair trends in a north-east and south-west direction, and is rather peculiar in outline, resembling somewhat the italic letter *f*, constricted in the central portion, where a ridge crosses the loch with a maximum depth of 36 feet on it. The loch widens and deepens on each side of this constriction, the maximum depth of the loch having been found in the north-eastern part, where the loch is widest, the greatest depth observed in the south-western part being 49 feet. The 25-feet basin is a continuous area over a mile in length, approaching close to the northern shore, but distant about a quarter of a mile from the south-west end. The area of the lake-floor covered

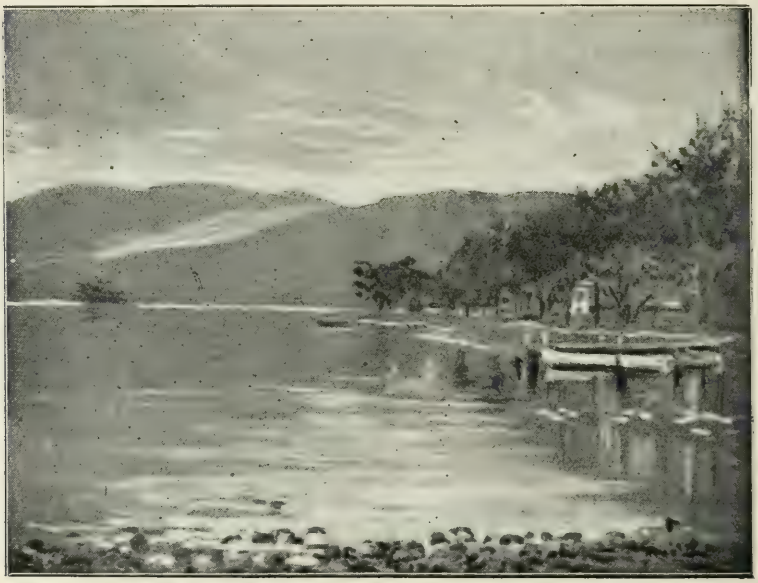


FIG. 14.—LOCH EARN.
(*Photo by J. Parsons, B.Sc.*)

by less than 25 feet of water is about 72 acres, or 53 per cent. of the total area of the loch; the area between the 25- and 50-feet contours is about 59 acres, or 44 per cent., while the area covered by over 50 feet of water is about 5 acres, or 3 per cent. of the entire area of the loch. Loch Iubhair was surveyed by Dr. Johnston and Mr. Parsons, at the same time as Loch Dochart, on April 28, 1902, the level of its surface being a foot lower than that of Loch Dochart, viz. 512 feet above the level of the sea.

6. *Loch Earn.*[1]

Loch Earn is situated amid lovely surroundings, the hills on both

[1] Earn = water.

sides being clothed with rich woods, and splendid mountain scenery bounds the horizon towards the west, while on the south Ben Voirlich towers to a height of 3200 feet. It contains trout and salmon, and also *Salmo ferox*. It has been said that the loch is 100 fathoms (= 600 feet) deep in some places, but this is disproved by the soundings taken by different surveyors. Mr. Grant-Wilson took over 180 soundings in 1888, Sir John Murray and the late Mr. F. P. Pullar took about 150 soundings in 1900, and the Lake Survey took 500 soundings in 1902, but in no case was the depth found to exceed 288 feet. On the accompanying map (Plate VII.) only the Lake Survey soundings are laid down, and the contour-lines drawn in from them.

Loch Earn is $6\frac{1}{2}$ miles in length, and four-fifths of a mile in maximum breadth, the mean breadth being three-fifths of a mile, or $9\frac{1}{2}$ per cent. of the length. The waters of the loch cover an area of over 2400 acres, or nearly 4 square miles, and it drains an area of over $54\frac{1}{2}$ square miles —an area fourteen times greater than the area of the loch. Five hundred soundings were taken in Loch Earn, the maximum depth observed being 287 feet, which agrees very well with the maximum recorded by Mr. Grant-Wilson in 1888, viz. 48 fathoms, or 288 feet. The volume of water contained in the loch is estimated at 14,420,638,000 cubic feet, and the mean depth at 138 feet, or 48 per cent. of the maximum depth. The length of the loch is 118 times the maximum depth, and 245 times the mean depth.

Loch Earn forms a simple basin, the lake-floor sinking gradually on all sides down to the greatest depth, as is well shown by the longitudinal and three cross-sections on the map. The 50-feet contour-line follows approximately the outline of the loch, approaching very close to the west end, where between the mouths of the Ogle and Kendrum burns a sounding of 57 feet was taken about 300 feet from the shore, giving a slope of 1 in 5·3. At the opposite end of the loch the 50-feet contour is met with about one-third of a mile from the bridge across the river at St. Fillans. The 100-feet basin approaches to within less than a quarter of a mile from the west end, and less than half a mile from the east end, and is over $5\frac{3}{4}$ miles in length; it covers an area of nearly $2\frac{1}{3}$ square miles. The 200-feet basin is $4\frac{1}{2}$ miles in length, stretching from three-quarters of a mile from the west end to $1\frac{1}{4}$ miles from the east end, and covers an area of $1\frac{1}{8}$ square miles. The 250-feet basin is nearly 2 miles in length, and a quarter of a mile in maximum width, extending from $1\frac{1}{2}$ miles from the west end to 3 miles from the east end. The maximum depth of 287 feet was observed near the centre of the loch, between the mouths of the Allt Bhacaidh on the north and the Allt Dhùnain on the south, about $2\frac{3}{4}$ miles from the west end, and $3\frac{3}{4}$ miles from the east end. The area of the lake-floor covered by less than 100 feet of water is about 926 acres, or $38\frac{1}{2}$ per cent. of the total area of the loch. The area between the 100- and 200-feet contour-lines is about 755 acres, or $31\frac{1}{2}$ per cent., and the area covered by more than 200 feet of water is about 700 acres, or 30 per cent. The flat-bottomed character of the loch is indicated by the last-mentioned percentage, which is nearly equal to the preceding one, though the interval of depth is only 87 feet as compared with the previous interval of 100 feet. The comparatively

uniform average slope from the shore down to a depth of 100 feet is shown by the fact that the areas on each side of the 50-feet line are nearly equal, viz. 477 acres (or nearly 20 per cent. of the entire area of the loch) between the shore and the 50-feet contour, and 449 acres (or nearly 19 per cent.) between the 50- and 100-feet contours.

Loch Earn was surveyed by Messrs. James Parsons and James Murray on May 14 to 19, 1902, and the level of the surface of the water was determined by levelling from Ordnance Survey bench-mark as 317·2 feet above sea-level. This is identical with the level determined by the surveyors of the Ordnance Survey on August 25, 1899.

On May 14, at 3.45 P.M. the temperature of the surface water near Lochearnhead was 46·1° (the air-temperature being 48°); at 6 P.M. the surface temperature was 44°, and at 7 P.M. near shore 47·2°. On May 15, at 11.30 A.M. the surface temperature near shore about a mile east of Lochearnhead was 44° (the air-temperature being 40·5°). On May 16, at 10.30 A.M. the surface temperature at the St. Fillans end of the loch was 44·1° (the temperature of the air at the time being 45°), and at 1.30 P.M. it was 44°. On May 17, at 5 P.M., the surface temperature off Dalkenneth over the deepest part of the loch was 43·8° (the air-temperature at the time being 47·7°). The range observed in the temperature of the surface water during those four days was thus 3·4°, from 43·8° to 47·2°, the range in the air-temperature during the same period being 7·5°, from 40·5° to 48°.

A series of temperatures beneath the surface was taken in the deepest part of the loch on May 17, at 5 P.M., with the following results:—

Surface	43·8° Fahr.
5 feet	43·5° ,,
10 ,,	43·4° ,,
20 ,,	43·3° ,,
30 ,,	43·2° ,,
50 ,,	43·2° ,,
100 ,,	43·1° ,,
125 ,,	42·3° ,,
150 ,,	42·1° ,,
200 ,,	42·0° ,,
250 ,,	41·5° ,,

This series shows a range of 2·3° between the temperature at the surface and that at 250 feet, the greatest fall being one of 0·8° between 100 and 125 feet.

The particulars regarding the different lochs dealt with in this part are collected together in the table on the opposite page, for convenience of reference and comparison.

From this table it will be seen that in the thirteen lochs under consideration, 2743 soundings were taken, and that the aggregate area of the water surface is about 15¼ square miles, so that the average number of soundings per square mile of surface is 180. The aggregate volume of water contained in the lochs is estimated at about 51,500 millions of cubic feet. The area drained by these lochs is about 353½ square miles, or over 23 times the area of the lochs.

SUMMARY TABLE

Giving details concerning the lochs described in this paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Drainage area.		
				Max.	Mean.		Max. feet.	Mean feet.	Mean per cent. of max.	Max.	Mean.		Area in square miles.	Total in square miles.	Ratio to area of loch.
Buidhe	981·0	39	0·32	0·24	0·16	50·0	3	1·500	50·0	563	1126	2	0·05	11·12	222·40
na Stainge	966·5	55	0·54	0·40	0·15	27·8	14	5·097	36·4	204	559	11	0·08	11·79	147·37
na h-Achlaise	962·0	112	0·82	0·76	0·35	42·7	28	9·580	34·2	155	452	76	0·29	1·08	3·72
Bà	957·0	315	2·15	1·02	0·43	20·0	30	8·098	27·0	378	1402	206	0·92	17·41	18·92
Laidon and Dubh Lochan	923·9	486	5·30	0·70	0·34	6·4	128	35·194	27·5	219	795	1,762	1·80	47·66	26·43
Sròn Smeur	...	68	0·56	0·22	0·14	25·0	33	10·310	31·2	90	287	23	0·08	1·89	23·62
Eigheach	818·2	78	0·88	0·21	0·10	11·4	28	6·088	21·7	166	763	16	0·09	63·42	704·66
Rannoch	668·0	808	9·70	1·12	0·76	7·8	440	167·460	38·1	116	306	34,387	7·37	243·57	33·05
Dochart	513·0	67	0·62	0·16	0·11	17·7	11	5·021	45·6	298	652	10	0·07	38·85	555·00
Iubhair	512·0	107	1·35	0·32	0·16	11·9	65	24·960	38·4	110	286	147	0·21	44·61	212·43
Lyon	1050·0	109	1·74	0·26	0·21	12·1	100	44·870	44·9	92	205	461	0·37	10·56	28·54
Earn	317·2	499	6·46	0·80	0·61	9·5	287	137·830	48·0	118	245	14,421	3·91	54.68	13·98
		2743										51,522	15·24	353·42[1]	23·19

[1] It must be remembered that the drainage area of Loch Rannoch includes the areas draining into the other lochs given at the head of the table, and that the Loch Iubhair drainage area includes that of Loch Dochart.

REMINISCENCES OF CHINA AFTER THE RECENT TROUBLES.

By B. W. Mainprise, R.E.

In October of the year following the troubles everything in China was quiet and peaceful, but none the less interesting.

As we glided up the river past Tongku, the port of Tientsin, to Sinho, where the British had pegged out their claim, I came to the conclusion that I was arriving in China on some red-letter day of the calendar. On all sides were flags; the bank of the river seemed fringed with them; houses, towers, telegraph posts—everything was beflagged. But it was no feast-day; these were merely the flags of the various nationalities denoting the boundaries of their various claims, lawful and otherwise. The Union Jack was scarce for two reasons: firstly, British reserve is averse to flagging every corner and mound, and secondly, the Union Jack was neither plentiful nor easy to make.

Tongku even then appeared in a state of disorder, whilst Sinho appeared to be quietly slumbering. At all times peace and quietness had reigned at this latter place. As each nationality arrived at Tongku in the troublous times, it seized a portion of the wharfage, and, with such labour as could be secured, tons of stores and material were dumped on shore. Chinese labour was at a premium; space was at a premium; everybody had his own language and his own methods of driving this language home. Pilfering and quarrelling were rife, and the game appeared to be to catch another man's coolies at any cost. At Sinho there was an orderly bustle and stir, for the Indian contingent were willing workers, and keen foresight had provided a special coolie corps from India. Discipline and a common language made the rest plain sailing.

The journey from Sinho to Tientsin afforded an opportunity of seeing the units of the various nationalities, and the little Jap quickly attracted attention. But from the first I had a secret admiration for the Russian and his methods of war, which were plainly visible from the train. There was scarcely a sign of life to be seen on either side of the line, ruined villages and desolation extending as far as the eye could see, although it was over fifteen months since the sword had passed over the country in real earnest. The Russians saved Tientsin; and it is almost a certainty that had Tientsin fallen nothing could have saved the Legations in Pekin.

The sight of a British sailor collecting tickets on the train prepared one for much, but the medley of nations at Tientsin station was extraordinary to a degree. There were soldiers of France and Germany, of Russia and England, some stolid and indifferent, others eager and anxious. Sailors from Italy, Americans, Austrians, dapper little Japs, Indian followers, and Chinese train-hands all swelled the motley crowd. At one end of the station was drawn up the Indian Guard—impassive Sikhs, half a head taller than the rest of the crowd. Behind

all was a line of Chinese coolies, who pounced on the train immediately it came to rest; and then it was that the baggage-van would become the most veritable babel of tongues which the modern world could possibly produce. Over all this reigned the railway staff officer, one at each of the important stations, picked British officers, good linguists, and of a tact and patience inexhaustible.

The foreign settlement of Tientsin gave peculiar evidence of national traits. At one end were the Germans, busily building what appeared to be barracks, a military air pervading the whole concession. Then came the British concession, alive with commercial activity, unfortunately not entirely British. The river front and side streets were piled high with boxes and bales of merchandise, which strings of loaded coolies in the groaning trolleys were trying to stow away in capacious stores. Then came a concession whose river front was laid out in gardens, and whose streets were defined by electric lighting standards, whilst here and there tables and chairs invited the passer-by to tarry and refresh himself. This was the French concession. Further on the Japanese concession was a scene of hurry and scurry, with many small boats and flags and plenty of poles and bunting, but what was happening was never quite apparent. Across the river were the Italians, their flags being the only outward and visible signs of this fact. Next to them came the Russians, mysterious and unknown. Nothing of their doings or intentions ever transpired.

In Pekin the Legation Quarter was a busy scene, with substantial and commodious buildings rising up on all sides from amongst the débris, their size and solidity testifying to their intentional permanency. These had all, save that of the Russians, who informed the rest of the allies that they would take their own measures for defence regardless of the surrounding Legations, been planned and erected on a combined scheme of defence, the outer boundaries in all cases being a stout loopholed wall. In one instance it could be noticed that the loopholes had been filled in on the outside so as to minimise their appearance of aggressiveness. Legation Street, where at least one guard of every nationality was mounted, still showed very visible signs of the fighting, the walls on either hand, and especially at projecting corners and waterpipes, being speckled and splashed with bullet-marks.

The first return of the Imperial Court to the capital was a brilliant and wonderful scene, and at the same time marked an event of no small importance, namely, the first public journey of the royal family in a train. Considerable pains had been taken to ensure the success of this journey, and the favourable light in which railways are now regarded in China may be considered as the result of this successful trip. The chief entrance to Pekin is at the Chien-men gate, where there is a large courtyard, one of the gates of which is only opened for the going and coming of the Court. In this enclosure was focussed the whole glory of the various portions of the great procession. For some forty minutes we were afforded a perfect kaleidoscope of colours. Each mandarin was heralded by scarlet umbrellas, varying in number and size with his rank, whilst the brilliancy of his raiment, with its exquisite embroidery, was accen-

tuated by the sordid trappings of the sorry little Chinese ponies (but stout-hearted withal), with their coats for ever and for aye untouched by currycomb or brush. The whole of this colouring was set in a fixed framing of dull blue and red, the uniforms of Viceroy Yuan-shi-kai's soldiery, who, together with the surrounding crowd, dropped on both knees when the coming of the royal chairs, masses of yellow and gold, was signalled. The Emperor arrived first, but was little noticed, for all were anxious to catch a glimpse of that wonderful woman, the Empress Dowager. On arrival she alighted from her chair, and, after offering obeisance at the two small temples in the courtyard, surprised all beholders by that now famous exhibition of friendliness to the foreigners. Folding both hands in the loose of her sleeves, she gazed up at a small knot of them on the wall above, and for some moments stood bowing and shaking her hands up and down in the friendly style of the Chinese, whilst the surprised "foreign devils" found themselves unconsciously bowing and taking off their hats to her in return.

Some three months' marching in the interior through the provinces of Chihli, Honan, and Shansi afforded ample opportunities for personally judging of the wealth of the country and the characteristics of the people. As regards the former, I do not consider that the optimistic statements which have been made regarding both agriculture and minerals are at all exaggerated, but this wealth of these is useless to the world at large without railways and improved communications. As regards the Chinaman himself, I would say nothing but good; he must not be confounded with the low-class lot (I am referring to the masses) which are met with at the Treaty ports, and of whom the traveller rightly forms but a low opinion, just as England must not be estimated by the crowd found in and around the docking centres. With considerate treatment John Chinaman exhibits a host of good qualities, but want of consideration for his feelings turns him into a "passive resister" of the most hopeless and obstinate type. Everything then goes wrong, and life becomes a burden.

Possibly a few words regarding a journey home over the Siberian Railway in the depth of winter may be of interest. The journey from Pekin through Niuchuang, Harbin, and over the Kingan hills, and thence across Lake Baikal to Irkutsk, took eleven days, and was certainly uncomfortable, for at that time the regular service of trains was not in operation. The winter scenery of snow and ice on all sides was very fine, and the Russians themselves were pleasant companions, but their partiality to warmth at any cost is particularly trying to an Englishman. The passage of forty-seven miles across Lake Baikal was accomplished in the *Angara*, a vessel of some 1500 tons, in about six hours. Although she was preceded by the ice-breaker *Lake Baikal*, a very powerful vessel of 4200 tons, which started out two hours in advance, yet at times she was brought altogether to a standstill by the ice, the temperature at the time being some 30° Fahrenheit below zero.

From Irkutsk to Moscow the journey of seven and a half days in the luxurious "Wagons Lits" train was much appreciated, and a long sleigh drive in the snow on arrival through the keen, crisp atmosphere quickly

invigorates one again after the confinement of the train. A visit to St. Petersburg delayed my arrival in London by one day, but including this delay the journey lasted twenty-two days, and was a marvellous and instructive return for a total expenditure of fifty pounds.

THE GERMAN ANTARCTIC EXPEDITION.

THE following details are taken from Dr. von Drygalski's official report, the main contents of which were noted in our last issue :—

On February 21 the announcement of land was made, and the explorers found themselves in front of a coast entirely covered with ice, evidently the termination of an inland ice-sheet. At the edge of this a depth of 219 fathoms was sounded. The party then sailed westwards, taking magnetic observations and dredging, until on the morning of the 22nd they found themselves enclosed by heavy ice-blocks, in which they remained imprisoned for almost a year.

This winter station of the *Gauss* was situated in pack-ice, and not close to the land. The mass of ice was found to be perfectly firm, and remained so till a few days before the final release. A slight rotation of the whole mass of ice seems to have occurred, which was afterwards fully determined, but in the course of the year it never amounted to more than half a degree, and continued slowly and steadily in the same direction. Otherwise the mass was as stable as land, and afforded the same conditions for scientific work, so that even pendulum observations could be carried out. The situation was more convenient for free movement than a land station, and the close connection with the sea which could be established at the ship itself, or through the floe ice, had advantages for the biological work, and indeed also for the magnetic and meteorological, which a station on land could not have afforded.

The installations of the scientific station were as follows :—

(1) Two magnetic observatories, of which one was set apart for the photographically registering variation apparatus, while the other served for absolute magnetic measurements. These were at first erected on a great floe about 350 yards south-west of the *Gauss*, and were built of ice-blocks, the first receiving a lining impervious to light. In the middle of June a removal became necessary, and the houses were accordingly built anew in a small iceberg 250 yards south-south-east from the *Gauss*, and were kept in regular working order till January 30, 1903.

(2) The meteorological station with all its accessories was erected about 40 yards south-south-east of the *Gauss*, but on January 10 was removed to another site east-north-east of the ship, as the hut in the first situation had melted away, and its position had become less accessible.

(3) An astronomical observation hut of wood, erected for meridian observations, and also serving as a gravity observatory, was set up 200 yards west of the *Gauss*, encircled by a double series of sights, which

also surrounded all the other installations of the station for the purpose of determining their displacements.

(4) Two holes in the ice at the bow and stern of the *Gauss*, with blocks and windlasses to raise and lower the nets for biological work. From the beginning of January a fissure which had been opened 600 yards south of the *Gauss* was generally used for this purpose.

(5) An arrangement for tidal observations at the bow of the *Gauss*, consisting of a scale fixed to the jib-boom, which rose and fell with the tide, beside a pointer connected with the bottom 210 fathoms below by a wire heavily weighted. Apparatus was also fixed fore and aft to determine the direction and strength of the currents.

(6) Two apparatuses for the measurement of the temperatures of the ice and sea by a combination of the electric and ordinary thermometric methods. One of these was placed on an iceberg fully half a mile from the ship, and reached down to a depth of 100 feet below its flat surface, the other on an ice-block, and then on the drift that accumulated over it from the stern of the vessel eastwards. The latter experienced many changes; at first it reached down to 30 feet below the surface—that is, below sea-level. Its lower parts sank beyond recovery, in consequence of an enormous increase caused by a snowstorm in the middle of July 1902, and was then kept working for some time at depths down to sea-level, until in December it was extended down to 100 feet below sea-level. The smithy, kennel, magazines, etc., had frequently to be moved owing to the snow and the sinking of the ice under its weight.

In March three balloon ascents were made one fine clear day by the leader of the expedition, the captain, and Dr. Philippi. From a height of 1600 feet a very instructive view over the surroundings and the position of the *Gauss* was obtained. This survey was a guide in many of the subsequent undertakings. During the first two months of imprisonment, small excursions were often made from the *Gauss* to study the ice, erect geodetic marks, explore the neighbourhood, photograph, collect specimens of rock transported by the ice, to kill seals and penguins, and as holiday trips for the men. Two species of penguin were met with, the small Adelia penguin and the Emperor penguin. The larger penguins were very useful as food, especially for the dogs. Also the skins and fat were burned, and so saved fuel. The seals met with were Weddell's seal, the leopard seal, and the crab-eating seal. These, too, were of great service. Their flesh, and especially the liver, was liked by every one, and was preferred to that of penguins, so that after October the latter almost ceased to appear on the table. The fat yielded good oil for illumination, and the skins were often used as clothing.

Of the other forms of animal life, the gulls were constantly present in autumn and spring, and the hunting of the giant petrel was a favourite sport. The snowy petrel, *Thalassœca antarctica*, and the small Wilson's petrel were also seen, together with single specimens of the Cape pigeon. Of the sea-fauna, besides seals, a species of *Nototenia* was common in January and February, while another fish, a *Lycodes*, was only caught once.

The interval from the beginning of May to the beginning of September, the period of winter storms, and consequently of indoor occupation, may be considered the second period of imprisonment. The third sledge journey took place partly within its limits, and therefore was made under the least favourable circumstances. On return the *Gauss* was found prepared for the winter. As to work outside the station, a number of soundings taken by Captain Rufer during short sledge excursions of a day's duration gave an insight into the configuration of the surrounding sea-floor. The short intervals of fine weather were also taken advantage of for the collection of rock specimens on icebergs, study of the icebergs themselves, for photographic surveys, etc. Otherwise occupations were conducted indoors.

The third period of life at the station—from September to the beginning of December—gave opportunities for longer sledge excursions. These involved the prolonged absence of several members of the expedition—eight at most,—but caused no interruption in the regular course of work at the station. Almost every day, except when there were snowstorms, individual members or parties made short excursions. These were spent in measuring and examining the icebergs and floes in the neighbourhood, in taking photographs, in observing the seals and the bird life, in collecting the erratic rock detritus on the icebergs, in making additional soundings, in measuring the thickness of the ice, and in noting the changes in its position and the opening out of fissures and leads.

The fourth and last period of life at the station extended from the beginning of December 1902 to February 8, 1903. The condition of the ice prevented the party from going far from the ship, but the snowshoes were brought out, especially the Norwegian ski, and short sledging excursions continued to be made till the ice began to break up on January 30. The work of the station was carried on without interruption till that date, and was then stopped because the icebergs in the immediate neighbourhood began to move. At this time the vessel was set in order ready for departure, and works were started for the purpose of helping the ship out of its berth. This required hard labour, but on February 8, owing to the breaking of the ice, the ship was at last set free.

In all, between March and December 1902, seven important sledge journeys were undertaken from the *Gauss*, lasting respectively from a few days to a month.

On being freed from winter quarters on February 8, the first object was to investigate the coast region to the west, and with this in view a northerly course was taken, with the intention of diverging to west when possible. For some time, however, the ship was still impeded by the ice, but a release came on March 16. After vainly endeavouring to proceed further southwards, the ship was forced to turn north again on April 8.

THE SCOPE AND PRACTICAL TEACHING OF GEOGRAPHY IN SCHOOLS.

Dr. Alexander Morgan gives,[1] under this title, some valuable hints to teachers. The study of geography begins with the myths and fairy tales of childhood, with their descriptions of travels and adventures in strange countries. But, in order to be able to localise these, children must have some notion of direction and distance. We must therefore lead them to observe the different positions of the sun, and finally teach them how to find the cardinal points from its position at midday. A north and south line and an east and west one must then be traced with chalk on the floor of the schoolroom, and the direction of different objects named with regard to them. The children must then measure the distances of objects, at first roughly, and then more exactly. Having measured by pacing the lengths of the walls of the classroom, they should draw to scale a plan of the room, and then another and somewhat fuller plan, showing the relative positions of the doors, windows, fireplace, and benches. The playground, school buildings, and neighbouring streets might be treated similarly, and then a large and well-executed plan of the school and its surroundings should be shown to the children. Next, the children should be trained to estimate distances, indoors or out. After this preliminary instruction, a series of excursions should be made to some neighbouring eminence, from which the children should analyse the landscape into its hills, valleys, streams, etc. If the school be near the sea, the children will have an opportunity of discriminating also bays, capes, etc. All these excursions should take place during school hours, and should be regarded as an important part of the school work. The children, after each outing, should be asked to write an account of what they have observed. They should also be taught to make clay models of the natural features noted, and draw plans of them. A large and not very detailed physical map of the district should now be placed before the class, and in their subsequent walks and excursions the pupils should take simple hand-maps of the district with them, and compare the places immediately in view with the delineations of them in the map.

From the study of the visible region we should proceed to that of the places in close contact with it, and next to the study of the home land. To give the pupils their first ideas of the structure of England (or Scotland), we should tell them that the general direction of the mountain-chains is north and south, with a long, gradual slope eastwards to the North Sea, and a shorter slope westwards to the Atlantic. From this one passes to the river basins, the mountains that separate them, the industries and chief towns in the basins, and why they are located there. As this work is proceeding, the teacher should draw an outline map on the blackboard, and fill in, as simply as possible, the rivers, mountains, and other natural features in different colours; and only after a map has

[1] In the *Geographical Teacher* for June, pp. 48-66.

been gradually built up in this way should a wall-map of the country be shown to the class. The other two divisions of the United Kingdom should be treated in a similar spirit. We should then proceed to the geography of the world as a whole, pointing out on a large globe the relative positions of the oceans and continents. It should be explained to the children that each of the continents, except Africa and Australia, is divided into two slopes by an axis of mountains, just as explained for the home country, and the general geography of each continent should be treated in a manner similar to that already indicated.

Along with the elementary lessons in structural geography there should be going on concurrently a course of lessons in nature study. Up to this stage no text-book, either in geography or in nature study, should be put into the hands of the children. The teacher must be the book, directing the pupils by his skilful questioning, and furnishing them with all the guidance and information necessary. Again, in the whole of the geographical instruction our rule should be *multum, non multa*—we should not weary the children with minute details, our aim being to supply them with materials from which to make clear and simple generalisations. Finally, during the first survey of the home country and the world, only physical or structural maps should be used; that is, maps which indicate only the elevations and other surface features. The ordinary maps show everything on the flat, which, to the beginner, does not suggest the reality, and (their worst fault) they give an undesirable prominence to the political divisions.

Just as this preliminary course (lasting some three or four years) has as its aim to collect mental material, so the next and more strictly scientific course should have for its purpose to elicit from the pupils explanations of the causes of the phenomena already dealt with and the connections between them. During this more advanced course we should not aim at so detailed a knowledge as is at present too frequently attempted. So far as mere memory work is concerned, we should be content with a knowledge of such facts as we may hope that the children will be able to carry with them as part of their mental equipment for life. Thus, a pupil leaving a secondary school at the age of, say, sixteen complete, should have a general knowledge of:—

1. *The Home District.*—Its physical features and distribution of water, and how they have been influenced by the geological structure of the rocks. Distribution of arable and pastoral land. Climatic phenomena and their causes. Effects of the foregoing on the natural products, industries, and commerce of the district. How these influences have determined the distribution of the population and the position of the towns.

2. *The British Islands.*—The physical features, and, by comparing them with a geological map, to find out how the latter helps to explain the configuration. Natural products, commerce, industries, and chief manufactures. The counties, and the positions of the chief towns. The main lines of railway, and the chief stopping-places on them.

3. *Europe.*—Physical features generally. The countries and their capitals, and the positions of the chief towns. The characteristic

products and industries of the countries. The lines of railway connecting the capitals with each other and with the seaports.

4. *The World.*—Positions of the continents, oceans, and groups of islands. The political divisions and their capitals. The positions of the most important towns and seaports. The great trunk lines connecting the countries. More detailed study of the British colonies on the different continents. Their industrial relations with the mother-country.

5. *Atmospheric Phenomena.*—Condensation. Distribution of rainfall. Winds and their causes.

6. *The Ocean.*—Currents, their causes and effects. Tides.

7. *The Land.*—The forms of the land and the forces which shape them.

8. *The Movements of the Earth.*—Inclination of axis. Zones of climate. Time. Latitude and longitude.

9. *Bio-Geography.*—The principal species of plants and animals and their use. How their distribution has been influenced by physical features and climate.

10. *Anthropo-Geography.*—The influences of all the foregoing phenomena on man and his reaction on them. Races of mankind, their distribution, occupations, degrees of culture, and forms of government. More particular study of the people of the British Islands, their races, early history, language, religions, education, and government, and how all these have been influenced by physical causes and contact with other nations.

Suggestions as to Practical Work in Geography for the Older Pupils in Schools.

At the present time, in almost all our schools, the only practical work in geography done by the pupils consists in copying occasionally a more or less elaborate map at home, or, less frequently, in school. Now, as it is not our object to train the children to become cartographers, the many hours spent by them in these mechanical exercises are mostly wasted, and, indeed, worse than wasted, for the practice does positive harm by compelling the children to think too much about the map and too little about the real landscape it represents. What we must train the children to do is not to copy at second-hand from maps, but to draw at first-hand from Nature. After they have learned in this way the meaning of maps and how to construct them, no harm will be done by requiring them to copy or reproduce simple maps.

Any thoughtful teacher will have little difficulty in devising suitable practical exercises for the pupils during the later part of their study of geography. The following are a few that have been found interesting and useful:—

1. **To draw a Line in the Direction of Geographical North and South, and another in the Direction of Magnetic North and South, and thus find the Angle between them.**

2. **To draw a Plan of the Schoolroom correct in Scale and Orientation.**

3. **To draw a Plan of the School and its Environs.**

4. **To sketch, without Surveying Instruments, a Plan of what is seen from a Neighbouring Eminence.**

5. **To make a Map of a Certain District by Means of the Plane-table.**

6. **To make a Drawing of the Contour Lines at Vertical Intervals of, say, 10 feet along a Slope.**

7. **To make a Section or Profile along a given Straight Line in a Contoured Map.**

8. **To make from a Contoured Map a Relief Model either in Cardboard or in Clay of a Portion of the School District.**

9. **To practise using a Map in the Field.**—It will be found necessary to explain to the scholars that when actually using a map in the field it should be laid flat, with its cardinal points correctly placed as determined by a compass-needle, after allowing for the difference determined in Exercise 1, and that then they can tell the direction of any required object A by placing a stick on the map so as to pass through the representations of their standpoint and the place A on the map. After this the map should be prominent on all excursions until the pupils can perfectly read and interpret its symbols.

10. **To colour a Plain Map of the District so as to show the Condition of the Surface, especially as to Vegetation.**

11. **To draw Graphs of Commerce.**

12. **To determine the Obliquity of the Ecliptic and the Latitude of the School.**

13. For students in training colleges, a useful practical exercise would be to require some of them to conduct geographical excursions of school-children.

Such are some of the ways in which the teaching of geography may be made more real, more practical, and more interesting. To us, with our world-wide Empire and commerce, geography ought not to be the wearisome and unprofitable task that it now is. In the whole circle of school subjects none is better fitted under skilful teaching to train the pupils in the method of investigation, to cultivate their imagination, to develop their observing faculties, and thus help them towards a fuller enjoyment of the infinite variety, order, and beauty of the world.

GEOGRAPHICAL NOTES.

EUROPE.

Scottish Meteorological Society.—The half-yearly general meeting of the Scottish Meteorological Society was held in the hall of the Royal Scottish Society of Arts, Edinburgh, on July 18—Lord M'Laren presiding. Dr. Buchan read a paper on the "Rainfall of Scotland in relation to Sun Spots." The well-known cycle of eleven years was pointed out, and the long Rothesay rainfall record which began in 1800 was first examined. This remarkable register covered nine full cycles, and a close sympathy was shown to exist between the variations of rainfall and of sun spots. A set of maps was exhibited, showing the results of analysis of the rainfall at about 150 stations, the conclusion being established that the wettest years corresponded with the time of maximum sun spots, and the driest with times of minimum. This periodicity corresponded to the variations in wind direction, westerly winds being in excess at times of sun spot maximum, and easterly winds at a time of sun spot minimum. In the south-eastern counties of Scotland the curves were inverted, and the different parts of the world had to be dealt with separately. Generalisation was dangerous. Lord M'Laren said he considered that Dr. Buchan's investigation was a very important one, and he need hardly add that, like every statistical inquiry that Dr. Buchan undertook, he had carried it out in the most complete and rigorous manner. Mr. R. T. Omond thereafter made a communication on the location of rainfall stations in Scotland. The position of some 450 places at which rainfall is observed was shown on a map of Scotland, from which it appeared that they are most numerous in the populous parts of the country, and comparatively scarce in the more hilly districts, except where gauges have been established in connection with waterworks, such as around Loch Katrine and on the Pentland and Moorfoot Hills. For agricultural purposes, this present distribution was fairly satisfactory, but for questions affecting water-supply to towns and factories it would be desirable to increase the number of gauges in the Highlands and in the southern uplands. The district lying between the Firth of Clyde and the line of the Dingwall and Skye Railway and extending from the west coast to about the central line of Scotland, comprised barely one-fifth of the area of the mainland of Scotland. Yet in this region from one-third to one-half of the total rain and snow that falls in Scotland was concentrated. It was the region that we must look to for plentiful supplies of water in the future, for not only was the rainfall great, but most of it falls on elevated ground, where it could be easily stored and conveyed to where it was needed for supply or power. The Council would be grateful to any members of the Society who would help to establish gauges in this district or in the hillier parts of the south of Scotland. Sir John Murray remarked that a student might be appointed by the Carnegie Trust to study the rain-gauges over the different parts of the country, and have them established where they were wanted. Dr. Buchan and Mr. Omond were cordially thanked for their papers, and, on the motion of Sir John Murray, Lord M'Laren was thanked for presiding.

Course of Instruction on Marine Investigation.—Provided a sufficient number of students apply, a course of instruction in the above will be held in Bergen from September 1 to November 1, 1903. The instruction will consist partly in lectures and practical experiments, partly in guidance in laboratory work, partly in practical demonstration in the use of implements and instruments, and in excursions. The instruction and experiments are free of charge, and the

language employed will be English or German. The four following gentlemen will conduct the course :—Dr. Johan Hjort, Mr. B. Helland-Hansen, Dr. H. H. Gran, and Dr. A. Appellof. Applicants should write to Dr. Hjort (Norges fiskeristyrelses afdeling, Bergen).

ASIA.

A Russian Explorer in Lhasa.—M. Zybikoff, a Russian explorer, has recently succeeded not only in reaching the sacred city of Lhasa, the object of so many fruitless expeditions, but in residing there for a period of twelve months. M. Zybikoff is a Buddhistic Buriat of the Baikal region, and a graduate of the University of St. Petersburg, and it was owing to the fact that he was a Bhuddist and familiar with the language of Tibet that he succeeded in entering the country as a lama, and in bringing back the first reliable information of Lhasa since the frontiers of Tibet were closed after the expulsion from that country in 1846 of the French explorers Huc and Gabet.

It was in the summer of 1900 that M. Zybikoff entered the country, having approached Central Tibet by way of the Boumza Mountain, where Przhevalski was turned back in 1879.

Of Lhasa itself M. Zybikoff says that it has a picturesque location on the southern slope of a mountain, with luxurious gardens on the west and south. The Uitchu river passes to the south of the city, through which dykes and canals have been constructed as a protection against overflows. Surrounding the city is a fine broad street, which serves for religious processions and penitential exercises. Penitents go the length of this street, falling to the ground every five or six feet, so that in a day they prostrate themselves about 3000 times. The city, though small, having at most only 10,000 regular inhabitants, is an important commercial centre, the native traders being all women. In the centre of the city is the temple of Buddha. It is about 140 feet square, and is three stories high, with three gilded Chinese roofs. It contains the gigantic bronze statue of Buddha, which has a hammered gold jewelled headdress, in front of which burns a sacrificial fire fed with melted butter. A number of other statues and relics are kept in other chambers of the same temple, among which is the statue of the goddess of women, to which are offered spirits and wheat. The wheat is at once eaten by mice. The sacred edifice also contains rooms for the Dalai Lama and his council. The residence of the Dalai Lama, which, like the city, was built in the seventh century, is about a mile away from Lhasa, on Mount Bodala (Buddha La). Close by is the ancient castle of Hodson-Bodala, a structure 1400 feet long and nine stories high, in which are located the treasury, the mint, the schools of theology and medicine, as well as quarters for 1200 officials and 500 monks, and a prison. As many as 1000 priests participate in religious processions to this mountain. Among other monasteries and temples near Lhasa are three in which 15,000 monks are engaged, mainly in learned pursuits. At one of these, known as Brabun, nearly 6000 persons—boys, young men, and even grey-bearded patriarchs—are studying theology, the total number of resident monks being 8000. According to the current religious teaching in Tibet, there are many spirits which are continually reincarnated in men. The Dalai Lama is the living Buddha. Another defender of the faith is the spirit Choidshen, whose power is manifested through pious ascetics, who spend their lives in contemplation. Since the fifteenth century all power, civil and spiritual, has been nominally in the hands of the Dalai Lama, but China maintains a Manchu resident and an army. In order to avoid strife in selecting a Dalai Lama, the Electoral Council places three strips of paper with the names of three boys in an urn, and the

Manchu resident removes one with a small staff. The boy indicated on this piece of paper becomes the new Dalai Lama. His education is then intrusted to a college of learned men, and, until his twenty-second year, the Government is in the hands of a Regent appointed by the Emperor of China. The present Dalai Lama is twenty-seven years old. He is the fifth since 1806, one of the Regents having disposed of three while children. The Dalai Lama's Council, in whose hands the actual power mainly resides, embraces four so-called "Galons," appointed by the Emperor of China. The administration of the country is in the hands of a closed aristocracy, and bribery and corruption are nearly universal. Among the common penalties are drowning, torture, flogging, banishment, and fines. The Tibetan army consists of 4000 poorly disciplined men, armed with bows and old-fashioned guns. Robbery flourishes.

The explorer declares that the population, which has at times been estimated at 33,000,000, is probably not more than one-tenth of that number, and that it is decreasing through disease, particularly smallpox, and on account of the large number of celibate priests. The sons of Chinese soldiers and merchants temporarily resident in Tibet are counted as Chinese, while the daughters are regarded as Tibetans. Other foreign residents in Tibet are Indians from Cashmere, Mongolians, and Tibetans from Nepal, the latter being skilled artisans, architects, sculptors, and jewellers. Almost all the land in Central Tibet belongs to the Dalai Lama. Only high officials in Lhasa have hereditary homes. Tibetan houses are built of brick and stone, and are devoid of chimneys, except in the kitchen. The other rooms have holes to let the smoke escape, and are cheerlessly cold. Dried dung is the principal fuel. A curious custom with regard to clothing is that the common people wear white, the wealthy red, officials yellow, and soldiers blue garments of homespun. Jewels are worn in great abundance by the women. The chief articles of diet are barley meal, soup, the raw flesh of the yak and of sheep, butter, sour milk, and vegetables. Wheat spirits sell for a cent a bottle. Men smoke tobacco, and priests take snuff. The people of Central Thibet are passionately attached to their religious observances, which for the most part are purely formal. Prayers are regarded as of magical potency, and figure in all ordinary and extraordinary affairs of life. Medicine is in small popular favour. Morals are primitive, and marriage ties are loose. Both polygamy and polyandry are common. Agriculture and cattle-raising are the principal employments. Wheat, barley, pease, and beans, cattle, sheep, yaks, horses, asses, and mules are the main products. Yaks and asses are used as pack animals. Labour is cheap, men being paid two or three cents a day, while women usually serve in return for their keep. Even a lama receives only ten cents for a whole day's prayers. The exports are sheepskins, cattle, statues, books, yellow lama caps, and yak tails, which serve as horse tails in the outfit of Turkish Pashas. The imports are English and Indian cottons and woollens, and copper and enamel utensils from India, tea, silks, and cotton, and horses and asses from China.

M. Zybikoff has brought back with him from Lhasa an immense number of photographs and drawings, illustrative of the life and customs of the country, which will be included in a book he intends writing on the subject of his great journey.

AFRICA.

Tristan da Cunha.—A Bluebook recently issued gives some information of interest about the condition of this diminutive colony. In January Tristan da

Cunha was visited by H.M.S. *Thrush*, and Lieutenant Watts-Jones and Surgeon Lobb of that vessel drew up a report on the island which was forwarded by the Admiralty to the Colonial Office to be laid before the Secretary of State on March 26. The population, says this report, now consists of seventy-six persons, divided into seventeen families or households. All but four of the inhabitants were born in the island, two of the exceptions being Italians, who are described as being probably the best educated persons there. There have been no marriages in the island for three years. The islanders, though sunburnt, are described as being practically "white." The men are hardy, but not of fine physique; "the women are decidedly finer specimens than the men; . . . their features are regular, pleasing, and of somewhat Semitic type. The children are clean, fat, healthy, and well cared for, and surprisingly well clad." There is no definite sign, of mental or physical deterioration arising specifically from the system of intermarriage. The people generally, say the officers, were very anxious about the education of their children, and the difficulties attending this seemed largely responsible for the views they expressed on the subject of leaving the island. Their staple food is potatoes, milk, beef, mutton, and poultry produce, and of these there is an ample supply, but for anything beyond the inhabitants are entirely dependent on passing ships. Rats, which prevent the growing of any grain, are the curse of the island. Fish are plentiful, but the islanders are chiefly a farming community. "The *Thrush*," says the report, "took thirty-three cases to the island, all of which came from the Cape; this does not include the mails and some books which came from England. She brought back forty-five packages addressed to various people in Cape Colony, as the islanders said that unless they could send some of their things to their relations in the Colony, they would get no clothing." The schooner trade which used to be regularly carried on with the island has come to an end. It is pointed out that the island might in the future have a value, should a large carrying trade be established between South America and the Cape, as an intermediate station for wireless telegraphy; but this and the occasional assistance given to shipwrecked people seemed the only imaginable reasons for occupying it. The great majority of the people said they would like to quit the island if they could realise or receive compensation for leaving their stock behind them. Admiral Moore, in his despatch to the Admiralty covering the report of the *Thrush*, says that "the possibility of removal having been presented to the islanders, I submit it is very desirable a decision in the matter should be arrived at and communicated to them at the first possible opportunity, in order that they may remain no longer than is necessary in any doubt as to their future."

The Nile Dams.—The water stored during the winter in the Assouan reservoir for summer consumption has now been completely discharged. Notwithstanding the extremely low levels at Khartoum and Wady Halfa, the supply of Middle and Lower Egypt is well maintained, and the irrigation of the summer crops in those districts is assured. A largely increased area of cotton has been irrigated. The converted basins of the Assiut and Minieh provinces have received summer water for the first time. A large area of rice land, the irrigation of which was prohibited in former years when water was low, has also been watered. The rotations have been greatly modified, and the prohibition against the irrigation of land for sowing with maize, Egypt's most important food-crop, has been removed at the earliest date recorded. This is fortunate in view of the spread of the cattle plague, which has recently appeared. The highly successful results obtained in this the first year of the existence of the Assouan reservoir justify the

expenditure on the work, and the manipulation of the discharge reflects credit on Mr. Webb, the Director-General of Reservoirs, and his staff.

African Exploration.—Captain Lenfant, of the colonial artillery, with a naval lieutenant and a non-commissioned officer as sub-chiefs of his expedition, left France in July on an exploring mission to North-West Africa. The problem he has undertaken to solve is whether Lake Chad has a practicable outlet to the sea. He hopes to find a navigable way from the Atlantic to the great interior lake by following the course of the Lower Niger and then that of the Binue to Yola. From the latter place he will proceed along the Mayo Kebbi and will endeavour to find a channel across the swamps, taking advantage of the flood-waters after the rainy season, to the Logone, which leads into the Shari. He will then be in direct communication with Lake Chad, into which the river empties itself.

The explorer carries with him a steel launch in sections and five tons of stores. He will be towed up the Niger, but he will rely upon his boat in the later stages of his journey. Should he succeed he will have established a direct route from the mouth of the Niger to Lake Chad, occupying less than two months, and thus avoiding the long and difficult journey by way of the Congo. The cost of transport also would be reduced from 2000 francs to 500 francs per ton of merchandise. Captain Lenfant has had considerable experience in African travel and exploration. Some two years ago he carried up the Lower Niger a large quantity of government stores for the revictualling of the posts in the French Sudan and for the equipment of an arsenal at Bajibo. On this journey he successfully navigated the formidable Bussa rapids, which up to that time were regarded as impassable. He does not anticipate encountering such difficulties on the present expedition, as experienced boatmen tell him that the Binue is an easy river to navigate. The cost of the expedition is being defrayed by the Ministry of the Colonies, the Geographical Society, and the Committee of French Africa.

News has been recently received of Major Powell Cotton, who left England about a year ago on an expedition across Africa from Mombasa, *viâ* Lake Rudolph and the Upper Nile. After leaving Mount Elgon, to the north-east of Victoria Nyanza, and remaining some time with the cave-dwellers there, he marched due north, and since January has been travelling largely through unknown country. On May 11 he reached Obbo, some fifty miles to the north-east of Dufile. On January 1 the explorer left Mount Debasien, and proceeded through Karamojo to Tarash, in Western Turkana, in the Rudolph province. In this region the tribes did not prove to be unfriendly, and, contrary to expectation, the notorious Turkana gave no trouble to the expedition. The country, however, was difficult and waterless. North of Tarash Major Powell Cotton crossed Captain Welby's route and proceeded through Southern Dabossa and Dodinga to the Nile Province. During this portion of the route, part of which was unexplored, the natives were hostile. When last heard of, the explorer was in good health, and had secured some splendid trophies.

A Road for Automobiles in the Congo State.—Rapid progress is being made with the new road now under construction from Songolodo on the Congo Railway to Popokabada, on the Kuango. The distance is about three hundred and ten miles, and the road, which is to be nine yards wide on the plain and five yards on the mountain, is built especially for traffic by the new automobiles ordered by the Government. These vehicles will drag two tons over the road at the rate of twenty miles a day. The work is being carried out by three hundred natives under the charge of seven white officers.

British East Africa.—The following are extracts from a letter by Lord Delamere on the possibilities of development of British East Africa which appeared in the *Times*:—It seems to be scarcely realised in England that although in all probability the Uganda Protectorate will have to be developed by the natives themselves, with the help of a few planters and officials, there is in the East African Protectorate an area of about 45,000 square miles (nearly three times the size of Natal proper) in one block, through which the Uganda Railway runs for 200 miles, which is eminently fitted for permanent European colonisation. From 5000 feet to 8000 feet in height, this plateau, although on the Equator, has a temperate climate, and the absence of frost except in the higher parts makes it possible for a wide range of crops to be grown. European cereals and roots, maize, coffee, tobacco, and cotton grow side by side; bananas, oranges, melons, and figs bear heavy crops of fruit on land that can grow English apples, plums, etc. All European vegetables do exceptionally well, and some wonderful crops of potatoes have been produced. Trees grow at a great rate. . . . All that seems necessary to make this country pay back some of the enormous expense it has been to the British taxpayer is that it should get some small proportion of the stream of settlers flowing to other parts of the world. European children now living here thrive remarkably well. Agricultural land of good quality is to be bought cheaper than in any other British colony, and in certain parts free grants of 640 acres are to be made to early settlers. Grazing land can be leased at a very low rate, or bought if a man is willing to develop it.

AMERICA.

Mishongnovi Antelope-Snake Ceremonies.—Messrs. George Dorsey and H. R. Voth have published in the Anthropological Series of the *Field Columbian Museum Publication* an interesting account of certain of the ceremonies performed annually in the Hopi pueblos of Arizona. The antelope and snake societies co-operate, and their ceremonies form a very imposing spectacle. An important part of the ceremonies is the collection of a large number of snakes, about sixty to eighty, of which one-third to one-fourth are rattlesnakes. A very striking feature of the ceremonies is the freedom with which both the priests and naked boys handle the snakes with apparently entire impunity. This seems not to be due to any special treatment of the snakes, nor to any knowledge of an antidote to the poison, but to the fact that the Hopi thoroughly understand the disposition of the snake, and understand how to handle them without danger of a bite. The snakes are washed with "medicine," and are then carried in the mouths of the priests out of the kisi or booth of cottonwood erected for the purpose of the ceremony. The snakes are cast in a heap into a circle of white meal spread upon the ground, and from this mass are carried out in the hands of the priests, who start out to the north, west, and so forth, and deposit their snakes on the ground in company with bahos or prayer-sticks. The object of the ceremony is to prepare a medicine or magic which will be strong enough to overcome the magic of the rain-clouds, and cause them to give up their stores of water, which is essential at this season of the year for the maturing of the crops. As each snake is released with a baho, it bears with it prayers which it is supposed to transmit to the great plumed serpent, who has influence with the rain-gods of the four world quarters. The fundamental element of nearly all the Hopi ceremonies is said to be the production of a magic which will overcome the magic of the rain-clouds.

AUSTRALASIA.

Mangrove Swamps in the Gulf of Carpentaria.—In the *Queensland Geological Survey Report*, No. 180, are some interesting notes by Mr. C. E. V. Jackson, the assistant government geologist, on the influence of the mangrove on the history of the growth of the coast land of the Gulf of Carpentaria. Between the Norman and Albert Rivers the water is extremely shallow, and the shore is protected by a dense fringe of mangroves, behind which in the vicinity of the Albert River are vast salt-pans and marshes, which have been produced by the action of the mangroves in the following way. As is well known, the mangrove seed begins to germinate before it leaves the parent plant, and, owing to the position of the plants, when the seeds finally fall from the plant, they come under the influence of the tidal currents. The seeds are fusiform and float in a nearly vertical position, the heavier root end being downwards, while the lighter shoot end lies but little below the surface of the water. Owing to the shape of the root end, it speedily catches on the inequalities of the bottom, and there soon puts out additional rootlets which firmly fix it to the bottom. In consequence of this perfectness of the methods of distribution, a mangrove belt, once established, tends to extend itself rapidly, and, owing to the development of aerial roots, it acts as a barrier to the escape of land waters. The band of mangroves spreads outwards from the shore into the sea, its extension being only checked by the gradual deepening of the water or by excessive wave action. The belt of trees checks the littoral currents, and brings about a deposition of sediment, and the accumulation of débris of all kinds about the mangrove roots results in the formation of a very effective mole, separating the waters of the sea from those of the land. But as the belt of mangroves spreads seawards, the inland trees gradually die away, for want of the salt water which seems essential to their wellbeing. There is thus left on the landward side a belt of level swampy ground, continually increasing in width, owing to the seaward movement of the mangroves. The process is doubtless assisted by the gradual elevation of the district, and results in the formation of an immense belt of low-lying marsh. The ground naturally contains a large amount of salt, and this is dissolved out by rains, and then redeposited, so that over much of the surface there exist salt-pans, or extensive crusts of salt. These salt-pans are quite devoid of vegetation. In the shallow basins between the mouth of the Albert River and Burketown, considerable deposits of salt have taken place, and clean sheets occur, sometimes several inches thick and several acres in extent. From some of these pans the salt is collected commercially in the vicinity of Burketown. This salt-marsh country forms a large proportion of the lower coast land of the Gulf.

POLAR.

The Antarctic Relief Expedition.—The Government have undertaken the whole responsibility for the relief of Captain Scott and his companions, and a sum of £45,000 has been placed upon the Supplementary Estimates for the purpose. This large sum is rendered necessary by the fact that the Admiralty have purchased another ship, the *Terra Nova*, which is to take part in the relief in addition to the *Morning*. The *Terra Nova* is a Dundee whaler of 744 tons gross, and 450 net register, and has been fitted out for the expedition by the same firm which built the *Discovery*. The Admiralty have appointed Captain Harry Mackay, a Dundee whaling master, to the command of the relief expedition. The *Terra Nova* is manned by an entirely civilian crew, chiefly whalemen, and finally

left Dundee on her southward journey on August 23. She will thus be compelled to leave British waters many weeks later in the year than the *Discovery* and the *Morning* left, and is to be assisted on her passage through the Mediterranean by warships, which will take her in tow. In this way it is hoped she may arrive at Lyttelton in time to start at the same time as the *Morning*, which is already there, and has been taken over by the Admiralty. In the event of the *Discovery* being freed from the ice during the coming open season in the Antarctic, the Admiralty will make no objection to her carrying out the programme originally laid down—namely, that she shall return by way of the Southern Pacific round Cape Horn. But the officers and men of the Navy will not be permitted to remain any longer in the ice, and even if the *Discovery* has to be abandoned, Captain Scott will receive orders to return with the scientific staff and crew on board one of the relief vessels.

GENERAL.

The British Association.—The Southport meeting of this Association will begin on Wednesday, September 9. The Corporation of the town have placed the handsome suite of Municipal Buildings at the disposal of the Committee for use during the week of the Association's visit. These buildings include the Town Hall, Cambridge Hall, Art Gallery, and Victoria Science and Art Schools, all of which are now connected together. This block of buildings, which stands directly in the centre of the town, facing Lord Street, will be the headquarters of the Association. The Examination Hall of the Science and Art Schools and the large room of the Art Gallery will be used as reception rooms. Two other of the picture galleries will be set apart for reading and writing rooms, while a fourth will be allotted to the representatives of the Press.

Five out of the ten sections meeting this year will be located in the Municipal Buildings, while the remaining five sections are all located in buildings within three minutes' walk of the reception room. Sections D and E (Zoology and Geography) will meet in the Temperance Institute, London Street.

The Council of the Association will meet in the Council Chamber of the Town Hall, while two of the Corporation Committee rooms have been set aside for the deliberations of the International Meteorological Committee, which is meeting in Southport at the same time as the British Association.

The first General Meeting of the Association will be held on Wednesday evening, September 9, at 8.30, in the Opera House, when the President, Sir Norman Lockyer, will deliver his inaugural address.

The evening lectures will include the following three, which should prove of special interest:—

"Man as Artist and Sportsman in the Palæolithic Period," by Dr. Robert Munro.

"The Old Chalk Sea, and some of its Teaching," by Dr. Arthur Rowe.

"The recent Volcanic Eruptions in the West Indies," by Dr. J. S. Flett.

All these three lectures will be delivered in the Cambridge Hall.

Exploration in Indo-China.—On 25th April 1903 "la grande médaille d'or de la Société de Géographie de Paris" was voted to M. Pavie for his explorations in Indo-China from 1879 to 1895, and for his scientific works on his travels—ten volumes of ethnography and philology.

Demographic Statistics.—We have received from M. Marcus Rubin of the Institut International de Statistique, copies of a series of schedules which have

been drawn up under the direction of the Institute, with a view to obtaining reliable statistics in regard to semi-civilised or uncivilised peoples in regions where no regular censuses are conducted. The schedules are intended for travellers, missionaries, traders, administrators, and others who may have the opportunity of collecting information of this kind, in the hope of thus obtaining uniformity and precision of observation. The schedules should be properly authenticated, and the observer may either conduct his investigations as an individual, when his completed schedules should be returned direct to the Statistical Institute at Rome, or under the direction of some society which would then undertake the forwarding of the papers. The circulars may be recommended to the notice of all those whom business or pleasure leads to the confines of civilisation.

COMMERCIAL GEOGRAPHY.

Cotton Growing in British Guiana.—Reuter's agent at Georgetown writes on June 18: "The question of re-embarking in the cultivation of cotton is receiving serious consideration here. The country is admirably adapted for cotton growing; indeed formerly there were 400 cotton estates which exported 10,000,000 lbs. of cotton annually. The present agitation among manufacturers at home for colonial-grown cotton has once more directed attention to the possibilities of British Guiana. A Cotton Growers' Association has been started in Berbice to encourage the peasantry to take up the industry, and Dr. Morris, C.M.G., the Commissioner of the Imperial Department of Agriculture for the West Indies, is giving the enterprise the weight of his support. In an address to planters and others the commissioner declared that there was no doubt whatever that cotton, when carried on under favourable circumstances, was a perfectly stable industry. The prosperity of the industry in Texas would justify those interested in this colony carrying on experiments to judge whether cotton cultivation under present circumstances was suitable. If it did prove suitable, then the industry would gradually grow as the people became satisfied with the prospects of it, and cotton might become a subsidiary industry. Dr. Morris does not think that the cultivation ought to be confined entirely to peasant proprietors. What he would like to see are experiments conducted on estates under the supervision of the Board of Agriculture. Such a course would result in reliable data which would justify the planters looking into the matter and trying cultivation on perhaps a moderately large scale. It may be mentioned that the Board of Agriculture have imported a quantity of Egyptian seed for cultivation, and several planters have laid out land in experimental plots. The principal drawback to the adoption of cotton cultivation on a large scale is the scarcity of reliable labour, but this will not prevent peasant proprietors and planters from giving it a fair trial. There is great lack of employment for women of the peasant class and growing country lads; cotton picking would prove a godsend to such people.

Southern Formosa.—The report of Mr. Griffiths, the British Acting Consul in Southern Formosa, on his district for the past year shows a satisfactory growth of trade and prosperity over that part of the island. The volume of foreign trade at the two ports of An-ping and Ta-kau amounted to £919,819, against an average of £753,913 for the previous five years, the increase being especially marked in exports. Of this trade over 61 per cent. is with Japan, while as to the remainder practically the whole of the exports and about seven-tenths of the imports are the share of China, the balance of imports being divided between the United States and Great Britain in the proportion of about three to two, America

sending kerosene and flour, and Great Britain cottons, woollens, metals, and condensed milk. Except kerosene and flour, which are in the hands of local British merchants, the import trade from foreign countries is in the hands of Chinese; it is small, and is declining in the face of Japanese competition, all goods from Japan entering Formosa duty free. Japanese and natives control the import trade from Japan, while British merchants have a considerable share in the large exports of sugar and rice to Japan. Sugar is the most important article of export in Southern Formosa; its value last year was £414,528 in a total export trade of £496,508, or 83 per cent. of the whole, rice, hemp, and salt absorbing nearly the whole of the remainder. Of the sugar about 80 per cent. went to Japan and the rest to Hong-Kong, and the tendency of the trade is altogether in the direction of Japan. In connection with the preparation of sugar and rice for the market, as well as in irrigation, there is an opening for British machinery, and the report contains some details and advice on the subject. British shipping has a large proportion of the carrying trade of the district, though the large export trade with Japan is carried on wholly under the Japanese flag.

NEW BOOKS.

EUROPE.

The Beaten Track in Italy. London: Henry Gaze and Sons, 1903. *Price* 3*s.* 6*d.*

The aim of this little book is to provide the information wanted by visitors whose time is limited, and who therefore confine themselves to places of importance. This purpose is excellently fulfilled. A great deal of ground is covered in a small space, and the writing is above the interest of the average guide-book. Routes and hotel information are given, and among the illustrations are three views of ancient Rome, the work of Professor Nispi-Landi.

ASIA.

India, its Administration and Progress. By Sir John Strachey, G.C.S.I. Third Edition. Revised and enlarged. London: Macmillan and Co. Ltd.: New York: The Macmillan Company, 1903. *Price* 10*s.*

In these days, when we hear so much about "the illimitable veldt" and the claims and interests of our colonies of Australia and Canada, the appearance of the third edition of Sir John Strachey's well-known work on India is decidedly opportune. Amid the *Sturm und Drang* of opposing schools and statesmen, it is well that we should be reminded by one whose authority as an administrator, an expert, and a statesman is beyond dispute, "that the position of England as the greatest Power of the world, with which, indeed, her national existence in a form worthy of her is inseparably bound up, depends on the maintenance of her Indian Empire. . . . No Englishman who deserves the name will for a moment doubt our resolution to maintain our Empire, or that we can render India invulnerable, but statesmen will do well to remember that nothing can save us, sooner or later, from attack, except the certainty on the part of those who may desire to assail us, that every hostile attempt must end in disastrous failure. The condition among all others obviously essential to our success is one on which I need not dilate: absolute supremacy at sea gave to us our Empire, and without it the maintenance of that empire in India or elsewhere will be impossible." These are wise and weighty words, and so emphatically true that they should be seriously pondered and accepted without distinction of party.

The first edition of this remarkable work, published in 1888, was itself based on a series of lectures delivered in the University of Cambridge in 1884. A second edition was required in 1894, so the volume now before us may be called the third edition; but owing to administrative changes in India, such as the formation of the North-West Frontier Province and to the Census of 1901, a considerable part of the work had to be rewritten and brought up to date. The secret of the charm of this work is, that in every line there is the stamp of experience and authority. Sir John Strachey writes of what he knows, for he began life in India in the most junior grade of the Civil Service, and worked his way to the highest distinction possible in his service, viz. that of Acting Viceroy during the interregnum caused by the tragedy of the assassination of Lord Mayo. With him in his official career, and also, it may be said, in the compilation of this work, was associated his brother, General Sir Richard Strachey, who held undisputed pre-eminence as an authority on public works, such as railways, canals, and the like. It is no wonder then that Sir John now writes with the confidence and grasp of mind which invariably stood him in such good stead in former days. To these he adds an easy, persuasive, clear style, and a thorough comprehension of the various questions and problems with which he has to deal, while at the same time he is able to marshal on his side a host of well-known experts and indisputable authorities. In such a work he could not absolutely eschew figures, but the reader is not wearied or puzzled by indigestible statistics. There is no lack of anecdote or historical narrative to vary and enliven the work. Although Sir John is justly proud of the splendid work done by England in India, and triumphantly vindicates our past history there, he does not conceal the fact that much still remains to be done, many questions still to be solved, which demand the highest statesmanship and most delicate and sympathetic treatment—questions rendered all the more difficult of solution because natives of India, however enlightened and educated, are most reluctant to assist in their elucidation. The book, however, is a complete and crushing reply to writers of the school of Hyndman, Digby, and Lilly, and a successful vindication of the proud claim of England that the British Government in India is "not only one of the purest in intention, but one of the most beneficent in act, ever known among mankind."

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Sand-Buried Cities of Khotan: Being a Record of a Journey of Exploration through Chinese Turkestan. By M. Aurel Stein, Indian Educational Service. With over 150 Illustrations, Photogravure Frontispiece, and a large Map. Medium. 21*s. net.*

Neue Skizzen von der Adria. Theil III. Liburnien und Dalmatien. Von Josef Stradner. Pp. vii + 216. "Leykam" in Graz: Druck und Verlag, 1903.

Dawn in the Dark Continent, or Africa and its Missions. The Duff Missionary Lectures for 1902. By James Stewart, D.D., M.D. Pp. 400. 9 Maps. Demy 8vo. *Price* 6*s.* Edinburgh: Oliphant, Anderson and Ferrier, 1903.

Côtes et Ports Français de la Manche. Par Ch. Lentheric. Pp. iii + 319. 8 Cartes. *Prix* 5 *francs.* Paris: Librairie Plon Nourrit et Cie., 1903.

Highways and Byways in South Wales. By A. G. Bradley. With Illustrations by Frederick L. Griggs. Pp. xii + 410. Extra crown 8vo. *Price* 6*s.* London: Macmillan and Co., 1903.

A Search for the Masked Tawareks. By W. J. Harding King, M.R.A.S., F.R.G.S. With 41 Illustrations and a Map. Pp. viii + 334. Demy 8vo. *Price* 12*s.* 6*d.* London: Smith, Elder and Co., 1903.

Murray's Handbook for Travellers in Scotland. Edited by Scott Moncrieff Penney, M.A. Eighth edition. With 57 Travelling Maps and Plans. London: Edward Stanford, 1903.

Norway, Sweden, and Denmark: Handbook for Travellers. By Karl Baedeker. Eighth edition. 62 Maps and Plans. Leipzig: Karl Baedeker, 1903.

Also the following Reports, etc. :—

Annuaire Météorologique pour 1903. Par A. Lancaster. Bruxelles: Observatoire Royal de Belgique, 1903.

Statistica della Emigrazione Italiana. Per L'Estero Negli. Anni 1900 e 1901. Roma: Direzione Generale della Statistica, 1903.

Twenty-First Annual Report of the Fishery Board for Scotland for 1902. Glasgow, 1903.

Some Preliminary Results of an Expedition to the Malay Peninsula. By Nelson Annandale and H. C. Robinson. Pp. 12. London: Anthropological Institute.

Syllabuses of Instruction in Geography. In Elementary Schools and in Higher Schools. Pp. 17. London: Royal Geographical Society, 1903.

Washington Geological Survey Annual Report. Volume ii., 1902. Seattle, 1903.

Geographisches Jahrbuch. Band xxv., 1902. Von Hermann Wagner. *Preis* 15 *mark.* Gotha: Justus Perthes, 1903.

Monographs of the United States Geological Survey. Volumes xlii. and xliii.

United States Geological Survey. Forestry Series. Professional Papers Nos. 4-8.

United States Geological Survey. Geological Series. Professional Papers Nos. 1-3.

U.S. Department of Agriculture, Weather Bureau. Report of the Chief of the Weather Bureau, 1900-1901. Volume ii. Washington, 1903.

Maryland Geological Survey. Garret Country and Cecil Country. 2 vols. Baltimore, 1902.

British Rainfall, 1902. Compiled by H. Sowerby Wallis and Hugh Robert Mill, D.Sc., LL.D. London: Edward Stanford, 1903.

The Statistical Year Book of Canada for 1902.

Report on Canadian Archives, 1902. Ottawa: Department of Agriculture, 1903.

Geological Survey of Canada. Annual Report. Vol. xii., 1899. Ottawa: 1902.

Annual Report on British New Guinea from 1st July 1901 *to 30th June* 1902. Melbourne, 1902.

Administration Report of the United Provinces of Agra and Oudh, 1901-1902. Allahabad, 1903.

Report on the Administration of Bengal during 1901-1902. Calcutta, 1903.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th June 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas, Price 3s. each). *Forfarshire.*—Sheets XXVIII. 5; XXXV. 7, 9, 10; XXXIX. 16; XL. 13; XLV. 4, 8, 16; XLVI. 3, 4, 5, 7, 16; XLVII. 5; LI. 4; LII. 1 (2 and 3). *Inverness-shire.*—Sheets XXVIII. 6, 8; XXIX. 6. *Hebrides* (*Inverness-shire*). Sheets XXVI. 4; XXIX. 16. *Island of Skye* (*Inverness-shire*).—Sheets VI. 8; VII. 13; VIII. 5, 9; IX. 11; XII. 1; XV. 4; XVI. 7, 11, 12, 15; XVII. 9, 10; XX. 8; XXI. 1, 3; XXVII. 4, 7, 12; XXVIII. 1, 5; XXX. 14; XXXV. 3, 6.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Quarter Sheets—Revised, Price 1s. each). *Banffshire.*—36 NE., 36 SW., 36 SE.; 37 NW., 37 NE., 37 SW., 37 SE. *Kincardineshire.*—18 NW., 18 NE. With contours. *Forfarshire.*—26 NE., 26 SE.; 33 NE.; 45 NW.; 50 SW., 50 SE.; 51 SE. *Kincardineshire.*—14 SW. Full Sheets. *Hebrides* (*Inverness-shire*).—Sheets 12, 13, 32, 40, 47, 51; Price 2s. 6d. each. Sheets (4 and 8), 16, 19, 27, 36, 41, 56; Price 2s. each. *Islands of Skye, Rum, etc.* (*Inverness-shire*).—Sheets 37, 61; Price 2s. 6d. each. Sheets 1, 2, 5, 25, 26, 43 (53 and 54), 62, 69, 70, 72, 74; Price 2s. each. *Orkney.*—Sheets 80, 81, 85, 86, 88, 90, 92, 94, 95, 96, 98, 100, 101, 108, 109, 114, 119, 123, 124, 126; Price 2s. 6d. each. Sheets 77, 82, 84, 97, 99, 103, 111, 113, 116, 121, 122, 125, 127; Price 2s. each. Full Sheets—Engraved. *Aberdeenshire.*—Sheets 99, 100, 106; Price 2s. 6d. each. Sheet 77; Price 2s. *Banffshire.*—Sheets 43, 48; Price 2s. 6d. each. Sheet 44; Price 2s. *Inverness-shire.*—Sheets 60, 62, 63, 74 (75 and 75A), 77, 89, 92, 93, 94, 95, 103, 107, 108, 109, 110, 111, 117, 122, 123, 125, 149; Price 2s. 6d. each. Sheets 64, 104, 149A, 158; Price 2s. each.

ADMIRALTY CHARTS OF SCOTLAND. The Narrows of Raasay and Caol More. Scale 1 : 10,550. Surveyed by Captain A. Mostyn Reid, R.N., H.M.S. *Research*, 1901. No. 3302 (112). *Price* 2*s.* 6*d.*

Published by the Admiralty, May 1903.

SCOTLAND. Bartholomew's New Reduced Survey. Scale 2 miles to an inch. Sheet 5, Keswick and Borders. Sheet 17, Aberdeen and Deeside. With orographical colouring and roads revised by Cyclists' Touring Club. New Editions, 1903. *Price* 1*s.* *Mounted on cloth* 2*s.*

John Bartholomew and Co., Edinburgh.

THE GRADED ROAD MAPS OF SCOTLAND. Scale half an inch to a mile. Sheets—1, Edinburgh and District; 2, Glasgow and Ayr; 3, Galloway and Ayrshire; 4, Central Perthshire; 5, Aberdeen and Deeside; 6, Fife, Forfar, and East Perth. *Price per sheet,* 1*s. paper, and* 1*s.* 6*d. on cloth.*

Gall and Inglis, Edinburgh and London.

These maps are very clear and readable. The "grading" consists in colouring the roads to indicate the quality of their surface from a cyclist's point of view.

ENGLAND AND WALES. Bartholomew's New Reduced Survey. Scale 2 miles to an inch. Sheet 25, Bedford, Hertford, etc.; Sheet 37, Cornwall. With orographical colouring and roads revised by Cyclists' Touring Club. New editions 1903. *Price* 1*s.* *Mounted on cloth* 2*s.*

John Bartholomew and Co., Edinburgh.

STRIP ROUTE MAPS OF ENGLAND. Scale half an inch to a mile. 1, The Liverpool and Manchester Road; 2, The Carlisle Road; 3, The Exeter Road. *Price* 1*s. each.* *Gall and Inglis, Edinburgh and London.*

AMERICA.

DOMINION OF CANADA. Map issued by direction of Hon. Clifford Sifton, Minister of the Interior. From the latest information furnished by James White, F.R.G.S. 1903. *Ottawa, Department of the Interior.*

This is a popular wall map chiefly designed for the information of intending settlers.

UNITED STATES. Rand, M'Nally and Co.'s Indexed County and Township Pocket Maps. New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio. 1903. *Price* 25 *cents each.*

Rand, M'Nally and Co., Chicago and New York.

These new editions revised to date are of special value with the new indexes, including populations, according to the 1900 census.

PERU. Map of the Republic of Peru. Scale 1 : 3,000,000. With a short description of the country, its Geographical Features, Climate and Resources, Political Organisation, Agriculture, Commerce, Mining, and other Industries; its Railways and other Means of Communication, Education, Labour Statistics, etc. Under the authority of Don E. Larrabure y Unánue, Minister of Foreign Affairs, this sketch has been compiled. 1903.

Issued by Eduardo Higginson, Consul of Peru at Southampton.

A most useful reference map with descriptive matter of special interest to the student, financier, and emigrant.

ASIA, AFRICA, AUSTRALIA.

KOREA. A new Map compiled and transliterated by B. Koto, Ph.D. Scale 1 : 2,000,000. Accompanied by a Catalogue of the Romanised Geographical Names of Korea by B. Koto and S. Kanazawa. Published by the University of Tokyo, 1903. *Price* 90 *sen.* *Maruya and Co., Ltd., Tokyo.*

This map is drawn, engraved, and printed in Japan. It is a clear and effective piece of cartography, the only defect being the extreme faintness in the delineation of the rivers.

NIGERIA. War Office Map of Africa. Scale 1 : 1,000,000, or about sixteen miles to an inch. *Sheets*—50, Sokoto; 51, Kano; 52, Lake Chad. Compiled 1903. *Price* 2*s. each.* *Intelligence Division, War Office.*

QUEENSLAND. Geological Sketch Map. Scale forty miles to an inch. Prepared under the supervision of B. Dunstan, F.G.S., Acting Government Geologist, and compiled by H. W. Fox, at the Geological Survey Office, Brisbane, 1902. *Geological Survey of Queensland, Brisbane.*

This map forms a most valuable summary of the geological survey work in Queensland.

NEW ATLASES.

THE SURVEY ATLAS OF ENGLAND AND WALES. A series of eighty-four Maps and Plans, with descriptive text. Designed and prepared under the direction of J. G. Bartholomew, F.R.S.E. Published in twenty-one monthly parts, 1903. *Part* 4, containing four section maps of Doncaster, Lincoln, Bideford, and Exeter. *Part* 5, containing text and four section maps of Brecon, Cardigan, Milford Haven, and Swansea. *Part* 6, containing four section maps of Cromer, The Wash, Cardiff, and Bristol. *Part* 7, containing text and monthly rainfall and temperature maps, with plans of Newcastle, Hull, Bradford, Leeds, Bristol, Portsmouth, Plymouth, and Brighton. *Part* 8, containing four section maps of Whernside and Penyghent, Ripon, Scarborough, and Hull. *Price* 2*s.* 6*d. each part.*

John Bartholomew and Co., Edinburgh.

COLONIES FRANÇAISES. Atlas des ——. Dressé par ordre du Ministère des Colonies par Paul Pelet. Livraison 9. *Prix* 3 *francs.*

Librairie Armand Colin, Paris.

After an interval of more than a year between the issue of Parts 8 and 9, this Atlas is at last completed. We have noticed the separate parts as they appeared, and now congratulate the cartographer and publisher on the completion of such a valuable work at such a popular price. Part 9 contains a complete index, together with a very useful cartographic bibliography for each country. It has also a general world map showing French colonies, a general map of French colonies in Africa, and maps of the various French naval stations.

ATLAS UNIVERSEL DE GÉOGRAPHIE. Commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. No. 16. Péninsule Ibérique. *Price* 2 *francs each map.* *Librairie Hachette et Cie., Paris.*

ATLAS COLONIAL PORTUGUÊS. Ediçao Reduzida. Ministerio da Marinha e Ultramar. 1903. *Commisão de Cartographia, Lisboa.*

A handy Atlas of ten maps on various scales showing the Portuguese colonies.

STIELER'S HAND-ATLAS. Neue neunte Lieferungs Ausgabe von ——. Lieferungen, 15 und 16: Nr. 17 und 18, Österreich-Ungarn, Bl. 1 and 2. Nr. 38 Grossbritannien, Südl. Bl. Nr. 58. Ost-Siberien. *Price* 60 *pfennig each part.* *Justus Perthes, Gotha.*

MURRAY'S HANDY CLASSICAL MAPS. The Eastern Empires ——. 1, Empire of Alexander the Great; and 2, Empires of the Babylonians, Lydians, Medes, and Persians. With Index. *Price* 1*s. net.* *John Murray, London.*

WORLD. Physical Relief Map of the World on Mercator's Projection, embracing the Physical and Political features. Reproduced from actual models by an entirely new process by E. A. Mackenzie, geographical expert and map specialist. *Effingham Wilson, London.*

This is a map which might have been charitably passed by without comment, were it not for the very misleading description contained in its title. It may be the fault of the "entirely new process," or the "geographical expert," or both, but its physical as well as its political features are most ridiculously incorrect. It shows mountains on the plains of Siberia which appear as high as the Himalayas, while the Dutch East Indies are coloured as belonging to various nationalities.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B. F.R.S. D.Sc. AND LAURENCE PULLAR Esq., F.R.S.E.

LOCH BA
LOCHAN NA H-ACHLAISE
LOCHAN NA STAINGE & LOCH BUIDHE
(TAY BASIN)

LOCH BA AND LOCHAN NA STAINGE SURVEYED IN 1902 BY
SIR JOHN MURRAY AND T N JOHNSTON, M.B., C.M.
LOCHAN NA H-ACHLAISE AND LOCH BUIDHE SURVEYED IN 1902 BY
JAMES PARSONS B.Sc. H M CLARK B.Sc. AND D C M'INTOSH, M.A.

Height of Surface of Water above Sea Level Loch Ba 957 feet
Lochan Na H-Achlaise 992 feet Loch Buidhe 981 feet

The Land Contours are from the Ordnance Survey.

Scale 1 : 21120 = 3 MILES = 4.8 KILOMETRES = 1 CENTIMETRE

Bathymetrical Contours are at Intervals of 10 Fathoms

Beinn Cheathach

LOCHAN BEINN CHEATHACH

Eilean na h-Iolaire

Eilean Molach

LOCH BA

RANNOCH MOOR

LOCHAN NA STAINGE

Blue Ba

LOCH BUIDHE

Boat House

LOCHAN NA H-ACHLAISE

BLACK MT

Abhainn Ba

Dubh Lochan

DEPTHS IN FEET / METRES

DEPTHS IN FEET / METRES

CROSS SECTION

CROSS SECTION

ROAD TO BRIDGE OF ORCHY 1630

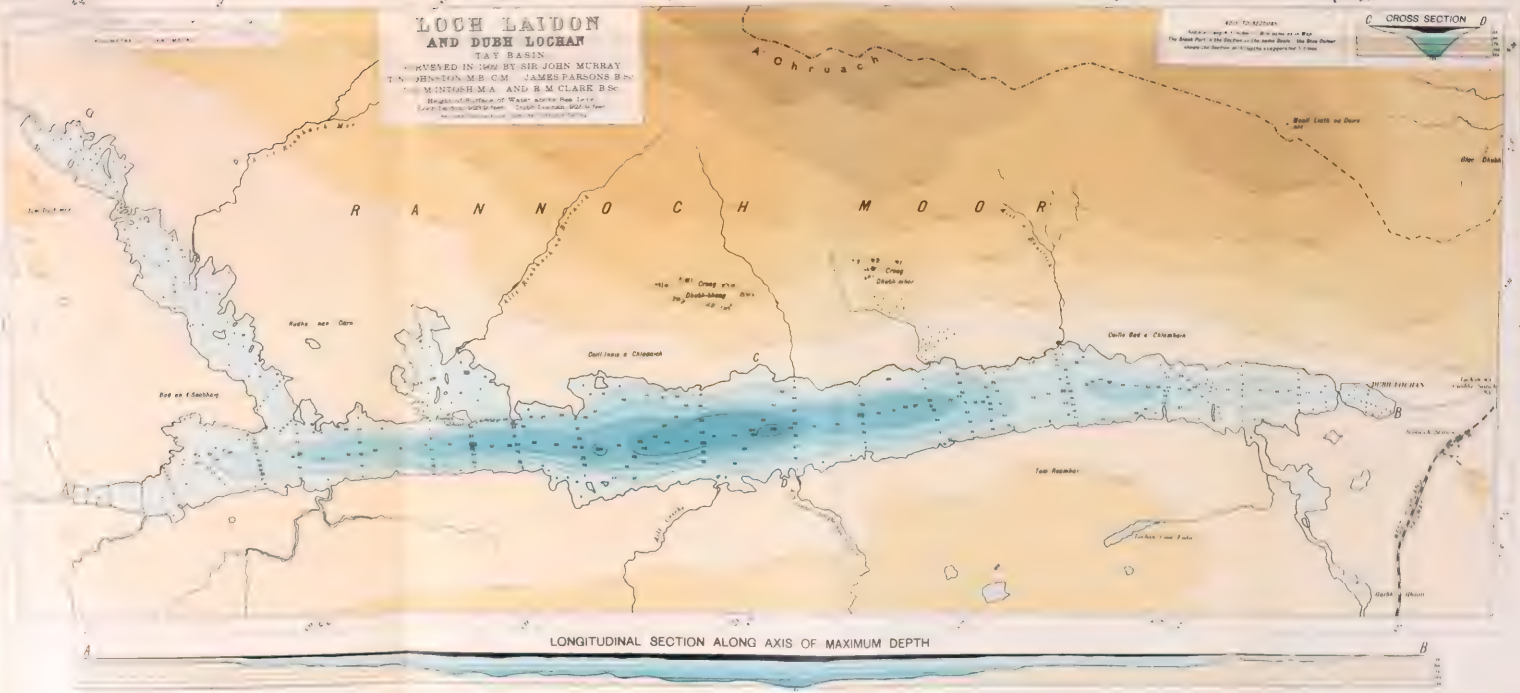
ROAD TO KINGSHOUSE

LONGITUDINAL SECTIONS ALONG AXIS OF MAXIMUM DEPTH

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

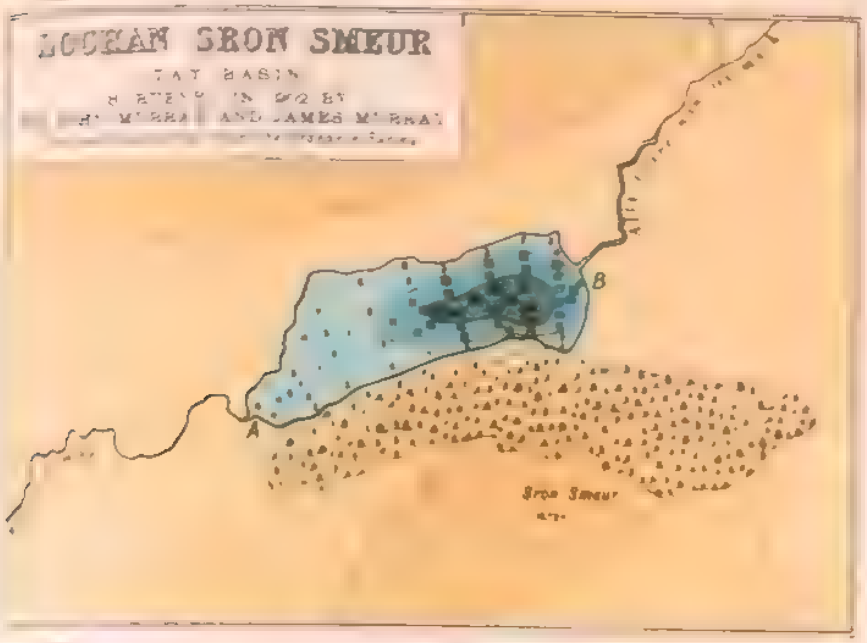
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, Esq., F.R.S.E.

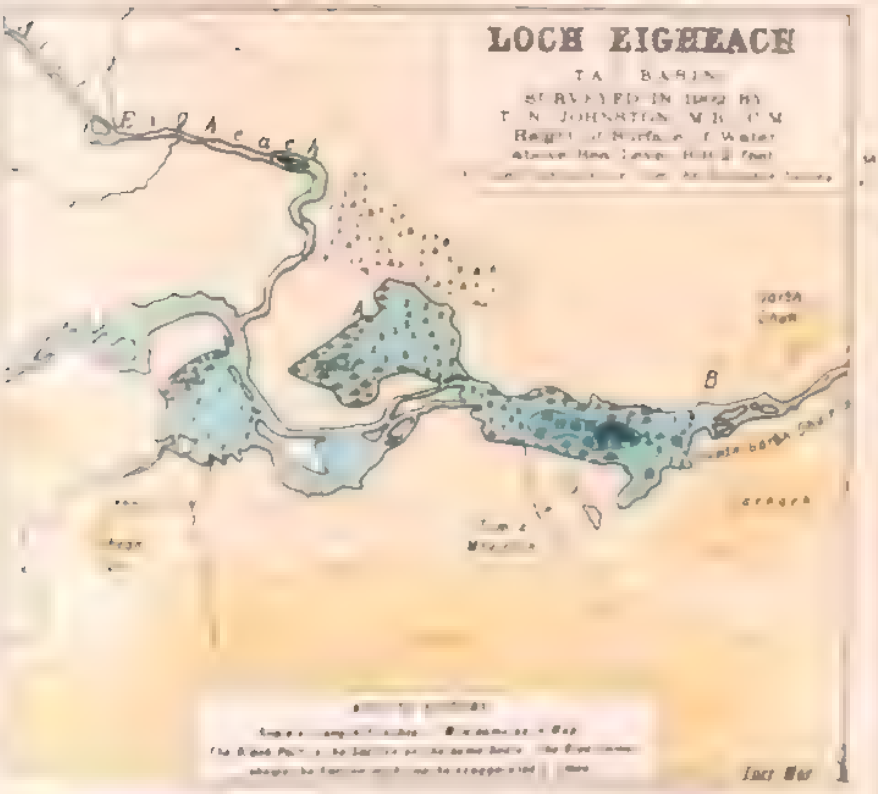


METRICAL SURVEY OF THE LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

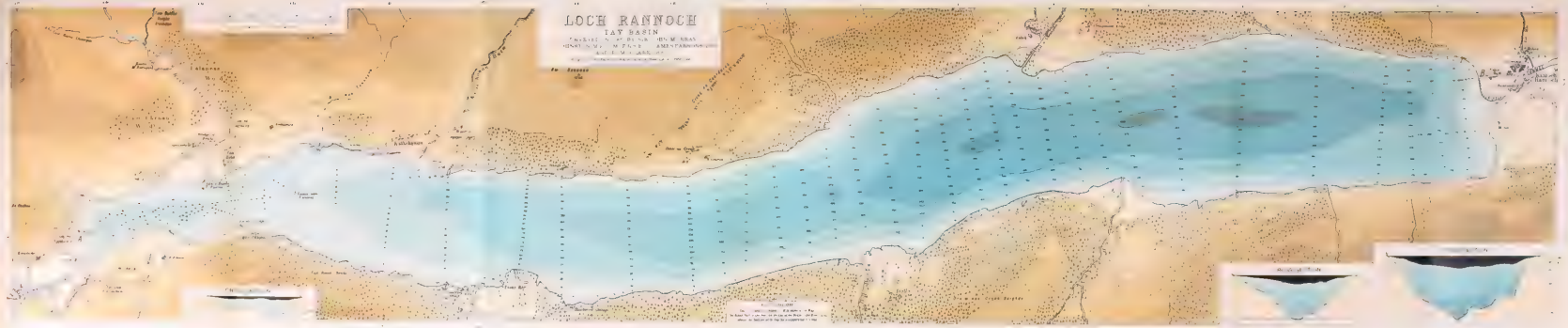
JOHN MURRAY K.C.B. F.R.S. D.Sc. AND LAURENCE PULLAR Esq. F.R.S.E.





BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

SIR JOHN MURRAY K.C.B. F.R.S. D.Sc. AND LAURENCE PULLAR ESQ. F.R.S.E.



BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, Esq., F.R.S.E.

LOCHS DOCHART & IUBHAIR

(TAY BASIN)

SURVEYED IN 1902 BY

T. N. JOHNSTON, M.B., C.M., AND JAMES PARSONS, B.Sc.

Height of Surface of Water above Sea Level.

Loch Dochart, 613 feet. Loch Iubhair, 612 feet.

The Land Contours are from the Ordnance Survey.

Scale 1 : 21,120 = 3 INCHES TO A MILE. Miles 1

1 KILOMETRE = 1 CENTIMETRE. Kilometres 1

NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile, the same as in Map.
The Black Part in the Section on the same Scale as the Base Colour shows the Section with Depths exaggerated 10 times.

CROSS SECTION C D

HEIGHTS IN FEET

DEPTHS IN FEET

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

A B

LOCH LYON

(TAY BASIN)

SURVEYED IN 1902 BY SIR JOHN MURRAY
T N JOHNSTON M B C M AND
JAMES PARSONS B Sc

Height of Surface of Water
above Sea Level 1052 feet

The Land Contours are from the Ordnance Survey

Eilean Riabhach
Gleann Meran
Allt Meran
Craag Dhubh
Craag Bhuidhe
Ford
Invermearan
LYON
Staing Cailliche
Bad nan Ceard
Meallan Odhar
Lubheasgarnich
Boat House
Allt Heasgarnich
Garbh Leachtir
Stob Garbh
Leachtir
Bad nan Buige
Benvannoch
Eing
Allt Kionaig Gillies
Allt Kionaig
Luban Tomochoarn
An Stuchd
A
B
C
D

CROSS SECTION C D

NOTE TO SECTIONS
Scale of Length 1 inches 1 Mile same as in Map
The Black Part is the Section on the same Scale the Blue Colour shows the Sect on with Depths exaggerated 5 t mes

1 KILOMETRE = 1 CENTIMETRE

HEIGHTS IN FEET

DEPTHS IN FEET

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH
A B

UNDER THE DIRECTION OF
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, ESQ., F.R.S.E.

LOCH EARN

(TAY BASIN)

SURVEYED IN 1902 BY
JAMES PARSONS, B.Sc., AND JAMES MURRAY

Height of Surface of Water above Sea Level 317·2 feet

The Land Contours are from the Ordnance Survey

Meall a' Mhadaid
Meall Reamhar
Creag Mascan
Easter Glenartney
Glenartney Wood
Creag an t'Sallsdair
Creag Bhuidhe
Creag an Aonaich
Wester Glenartney
Creag Bhuidhe
Creag Bhuidhe
Dun
Dorrie Wood
RAILWAY UNDER CONSTRUCTION
Ardveich Woods
Derry
Woolford Cottage
Ardveich
Dalveich
Tundallochy
Bridge of Ardveich
Tomvaich
Tolvine
Achraw
Lochearnhead
Kirkton Burn
Kirkton Bridge
Craggan
Edinample
Edinample Castle
Coilie Chriche
Ardveilich Cottage
Ardveilich House
Ashath Ranoch
The Haugh
Waterfall
Ballimeanoch
Allt Dhamain
Beallach Dhamain Burn
An Dùnan
Arrith a' Chreagain
Druim Ghonnaidh
Allt Sauge
Glen Ample
Ardvorlich
Ardvorlich Wood
Dun a' Choin Duinne
Creag an Fhogaidh na Maighdean
Fuar Chos
Bron Mhor
Bhac Laurach
Bronag Beag
Tri Monadh
St Fillans
St Fillans Park
Creag Bheithe
Creag Bheithe
Water Meadows
Water Meadows
Kingles
Tritronan
Ardveich Wood
Ardveich Wood
Ardveich Wood

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

TERRESTRIAL MAGNETISM IN ITS RELATION TO GEOGRAPHY.

By Captain Ettrick W. Creak, C.B., R.N., F.R.S.[1]

Of the six distinguished naval officers who have previously presided over this Section, four were Arctic explorers; and therefore, possessing personal experience in Arctic regions, they naturally gave prominence to the deeply interesting subject of the past and future of Arctic discovery in their addresses, whilst not forgetting other matters relating to the geography of the sea. The remaining officers, from their immediate connection with all that relates to the physical condition of the ocean, in its widest sense, coupled with the great importance of giving the fruits of their knowledge to the world, took that subject as their principal theme.

Valuable as are contributions to our knowledge of the physics of the ocean to the world in general, and especially to the mariner and water-borne landsman, I propose to take a different course, and bring to your notice the subject of Terrestrial Magnetism in its relation to Geography. In doing so, I shall endeavour to show that much may be done by the traveller on land and the seaman at sea in helping to fathom the mysteries connected with the behaviour of the freely suspended magnetic needle, as it is carried about over that great magnet, the Earth, by observations in different regions, and even in limited areas.

I would, however, pause a moment to call attention to the presence of several distinguished meteorologists at this meeting, who will surely attract many to the consideration of matters connected with the important science of meteorology, which already occupies considerable attention

[1] The President's Address to Section E (Geography) at the Southport Meeting of the British Association.

from travellers. I feel sure, therefore, that geographers will be glad to accord a hearty welcome to the members of the International Meteorological Congress now assembled in this town, and especially to the foreign visitors who honour us by their presence.

Some one may ask, What has Terrestrial Magnetism to do with Geography? I reply, Excellent lectures on that subject of growing importance have been given under the direct auspices of the Royal Geographical Society; one in 1878 by the late Captain Sir Frederick Evans, and another in 1897 by Sir Arthur Rücker. And I would here quote the opinion of Dr. Mill when defining geography, in my support: "Geography is the science which deals with the forms of the Earth's crust, and with the influence which these forms exercise on the distribution of other phenomena."

We know now that the normal distribution of the Earth's magnetism for any epoch is in many localities seriously affected according as the nature of the country surveyed be mountainous, or generally a plain, in the form of islands (or mountains standing out of the sea), and from land under the sea. There is also reason to suspect that the magnetism of that portion of the earth covered by the oceans differs in intensity from that of the dry land we inhabit. A connection between the disturbances of the earth's crust in earthquakes and disturbances of the magnetic needle also seems to exist, although the evidence on this point is not conclusive.

Magnetic Surveys.

Previously to the year 1880 there were two periods of exceptional activity on the part of contributors to our knowledge of the earth's magnetism, during which the scientific sailor in his ship on the trackless ocean combined with his brethren on land in making a magnetic survey of the globe.

The first period was that of 1843-49, during which not only were fixed observatories established at Toronto, St. Helena, Capetown, and Hobart for hourly observations of the movements of the magnetic needle, but, to use Sabine's words, "that great national undertaking, the Magnetic Survey of the South Polar Regions of the Globe," the forerunner of our present Antarctic Expedition, was accomplished by Ross and his companions almost entirely at sea.

This Antarctic survey was carried out during the years 1840-45, and the results given to the world as soon as possible by Sabine. The results afterwards formed a valuable contribution when constructing his maps of equal lines of Magnetic Declination, Inclination, and Intensity for the whole world, a great work for the completion of which Sabine employed every available observation made up to the year 1870, whether on land or at sea.

Readers of these contributions cannot fail to be struck with the great number of observations made by such travellers as Hansteen and Due, Erman and Wrangel, extending from Western Europe to far into Siberia.

The second period was that of 1870-80, during which not only was there much activity amongst observers on land, but that expedition so fruitful to science, the voyage of H.M.S. *Challenger*, took place. During the years 1872-76 we find the sailor in the *Challenger* doing most valuable work in carrying out a magnetic survey of certain portions of the great oceans, valuable not only for needful uses in making charts for the seaman, but also as a contribution to magnetic science.

Prior to this expedition very little was known from observation of the distribution of Terrestrial Magnetism in the central regions of the North and South Pacific Oceans, and Sabine's charts are consequently defective there.

Combining the *Challenger* magnetical results with those of all available observations made by others of H.M. ships, and by colonial and foreign governments, I was enabled to compile the charts of the magnetic elements for the epoch of 1880, which were published in the report of the scientific results of H.M.S. *Challenger*. I will venture to say that these charts give a fairly accurate representation of the normal distribution of the earth's magnetism between parallels of 70° N. and 40° S. Beyond these limits, either northward or southward, there is a degree of uncertainty about the value of the lines of equal value, especially in the Southern regions, an uncertainty which we have reason to hope will be dissipated when we know the full results obtained by Captain Scott and the gallant band he commands, for as yet we have to be content with some eddies of the full tide of his success.

Until the *Discovery* was built, the *Challenger* was the last vessel specially selected with a view to obtaining magnetic observations at sea, so that for several years past results obtained on land have been our mainstay. Thus, elaborate magnetic surveys with fruitful results have been carried out in recent years in the British Isles by Rücker and Thorpe. France, Germany, Holland, and some smaller districts in Europe have also been carefully surveyed, and British India partially so, by Messrs. Schlagintweit in 1857-58. The latter country is being again magnetically surveyed under the auspices of the Indian Government.

On the American continent the Coast and Geodetic survey of the vast territories comprised in the United States, which has been so many years in progress, has been accompanied by an extended magnetic survey during the last fifty-two years, which is now under the able direction of Dr. L. A. Bauer. Resulting from this some excellent charts of the magnetic declination in the United States have been published from time to time; and the last, for the epoch 1902, is based upon 8000 observations.

There are other contributions to terrestrial magnetism for positions on various coasts from the surveying service of the Royal Navy, and our ships of war are constantly assisting with their quota to the magnetic declination, or variation, as sailors prefer to call it; and wisely so, I trow, for have they not the declination of the sun and other heavenly bodies constantly in use in the computation of their ship's position?

This work of the Royal Navy and the Indian Marine is one of great importance, both in the interests of practical navigation and of science;

for besides the equipment of instruments for absolute determinations of the declination, dip, and horizontal force supplied to certain of our surveying-ships, every seagoing vessel in the service carries a landing compass, specially tested, by means of which the declination can be observed with considerable accuracy on land.

Although observers of many other objects may still speak of their "heritage the sea" as a mine of wealth waiting for them to explore, unfortunately for magnetic observations we can no longer say "the hollow oak our palace is," for wood has been everywhere replaced by iron or steel in our ships, to the destruction of accurate observations of dip and force on board of them. Experience, however, has shown that very useful results, as regards the declination, can be obtained every time a ship is "swung," either for that purpose alone, or in the ordinary course of ascertaining the errors of the compass due to the iron or steel of the ship.

As an example of this method, the cruise of the training squadron to Spitzbergen and Norway in 1895 may be cited, when several most useful observations were made at sea in regions but seldom visited. Again, only this year a squadron of our ships, cruising together near Madagascar, separated to a distance of a mile apart and "swung" to ascertain the declination.

I would here note that all the magnetic observations made by the officers of H.M. ships during the years 1890-1900 have been published in a convenient form by the Hydrographic Department of the Admiralty.

The fact remains, however, that a great portion of the world, other than the coasts, continues unknown to the searching action of the magnetic needle, whilst the two-thirds of the globe covered by water is still worse off. Amongst other regions I would specify Africa, which, apart from the coasts, Cape Colony, and the Nile valley to lat. $5\frac{1}{2}^{\circ}$ N., is absolutely a new field for the observer.

Moreover, the elaborate surveys I have mentioned show how much the results depend upon the nature of the locality. I am therefore convinced that travellers on land, provided with a proper equipment of instruments for conducting a land survey of the strange countries which they may visit, and mapping the same correctly, can, with a small addition to the weight they have to carry, make a valuable contribution to our knowledge of terrestrial magnetism, commencing with observations at their principal stations and filling in the intermediate space with as many others as circumstances will permit.

The Antarctic Expedition.

Of the magnetic work of our Antarctic expedition we know that since the *Discovery* entered the pack—and, as far as terrestrial magnetism is concerned, upon the most important part of that work—every opportunity has been seized for making observations.

Lyttelton, New Zealand (where there is now a regular fixed magnetic observatory), was made the primary southern base-station of the expedition; the winter quarters of the *Discovery*, the secondary southern base-

station. Before settling down in winter quarters, magnetic observations were made on board the ship during the cruise to and from the most easterly position attained off King Edward VII. Land in lat. 76° S., long. 152½° W., and she was successfully swung off Cape Crozier to ascertain the disturbing effects of the iron upon the compasses and dip and force instruments mounted in the ship's observatory.

As a ship fitted to meet the most stormy seas and to buffet with the ice, the *Discovery* has been a great success. Let me add another tribute to her value. From Spithead until she reached New Zealand but small corrections were required for reducing the observations made on board. The experience of Ross's Antarctic expedition had, however, taught the lesson that two wood-built ships, the *Erebus* and *Terror*, with but some 3° to 4° of deviation of the compass at Simon's Bay, South Africa, found as much as 56° of deviation at their position farthest south, an amount almost prohibitory of good results being obtained on board.

How fared the *Discovery*? I have been told by Lieutenant Shackleton —for the cause of whose return to England we must all feel great sympathy—that a maximum of only 11° of deviation was observed at her most southerly position. From this we may look forward hopefully to magnetic results of a value hitherto unattained in those regions.

At winter quarters, besides the monthly absolute observations of the magnetic elements, the Eschenhagen variometers or self-registering instruments for continuously recording the changes in the declination, horizontal force, and vertical force were established, and in good working order at the time appointed for commencing the year's observations.

I may here remind you that some time previously to the departure of the British and German Antarctic expeditions, a scheme of co-operation had been established between them, according to which observations of exactly the same nature, with the same form of variometers, were to be carried out at their respective winter quarters during a whole year, commencing March 1, 1902. Besides the continuous observations with the variometers, regular term-days and term-hours were agreed upon for obtaining special observations with them at the same moment of Greenwich mean time. Both expeditions have successfully completed this part of their intended work.

To co-operate in like manner with these far southern stations, the Argentine Government sent a special party of observers to Staten Island, near Cape Horn, and the Germans another to Kerguelen Land, whilst New Zealand entered heartily into the work. In addition, similar observations were arranged to be made in certain British and colonial observatories, which include Kew, Falmouth, Bombay, Mauritius, and Melbourne; also in German and other foreign observatories.

We have all read thrilling accounts of the journeys of the several travelling parties which set out from the *Discovery*, and of the imminent dangers to life they encountered and how they happily escaped them except one brave fellow named Vince, who disappeared over one of those mighty ice-cliffs, upon which all Antarctic voyagers descant, into the sea. In spite of all this there is a record of magnetic observations taken on these journeys of which only an outline has yet been given. Antici-

pations of the value of these observations are somewhat clouded when we read in one report that hills "more inland were composed of granite rock, split and broken, as well as weatherworn, into extraordinary shapes. The lower or more outer hills consisted of quartz, etc., with basaltic dykes cutting through them." Consequently, we have to fear the effects of local magnetic disturbances of the needle in the land observations, whilst buoyed up with the hope of obtaining normal results on board the ship.

Judging from some land observations which have been received, it appears that considerable changes have taken place in the values of the magnetic elements in the regions we are considering, but when making comparisons we have to remember the sixty years which have elapsed since Ross's time, and that he had nothing like the advantage of steam for his ships, or of instruments of precision like our present ship *Discovery*. His ships also were, as we have already remarked, much worse magnetically, causing far more serious disturbance of the instruments. Hence the changes we note may not be entirely due to changes in the earth's magnetism.

The observations made by the officers of the *Southern Cross* at Cape Adare in 1899-1900 also contribute to this question of magnetic change.

The Magnetic Poles of the Earth.

I will now refer to those two areas on the globe where the dipping needle stands vertically, known as the magnetic poles. The determination of the exact position of these areas is of great importance to magnetic science, and I will just glance at what is being done to solve the problem.

Let us consider the North Pole first, the approximate position of which we know best from observation. If one were asked to say *exactly* where that pole has been in observation times, whether it has moved, or where it now is, the answer must be, "I do not know." It is true that Ross in 1831, by a single observation, considered that he had fixed its position, and I believe hoisted the British flag over the spot, taking possession thereof; but he may or may not have set up his dip circle over a position affected by serious magnetic disturbance, and therefore we must still be doubtful of his complete success from a magnetic point of view. Although eminent mathematicians have calculated its position, and Neumayer in 1885 gave a place to it on his charts of that year, we have still to wait for observation to settle the question, for one epoch at least.

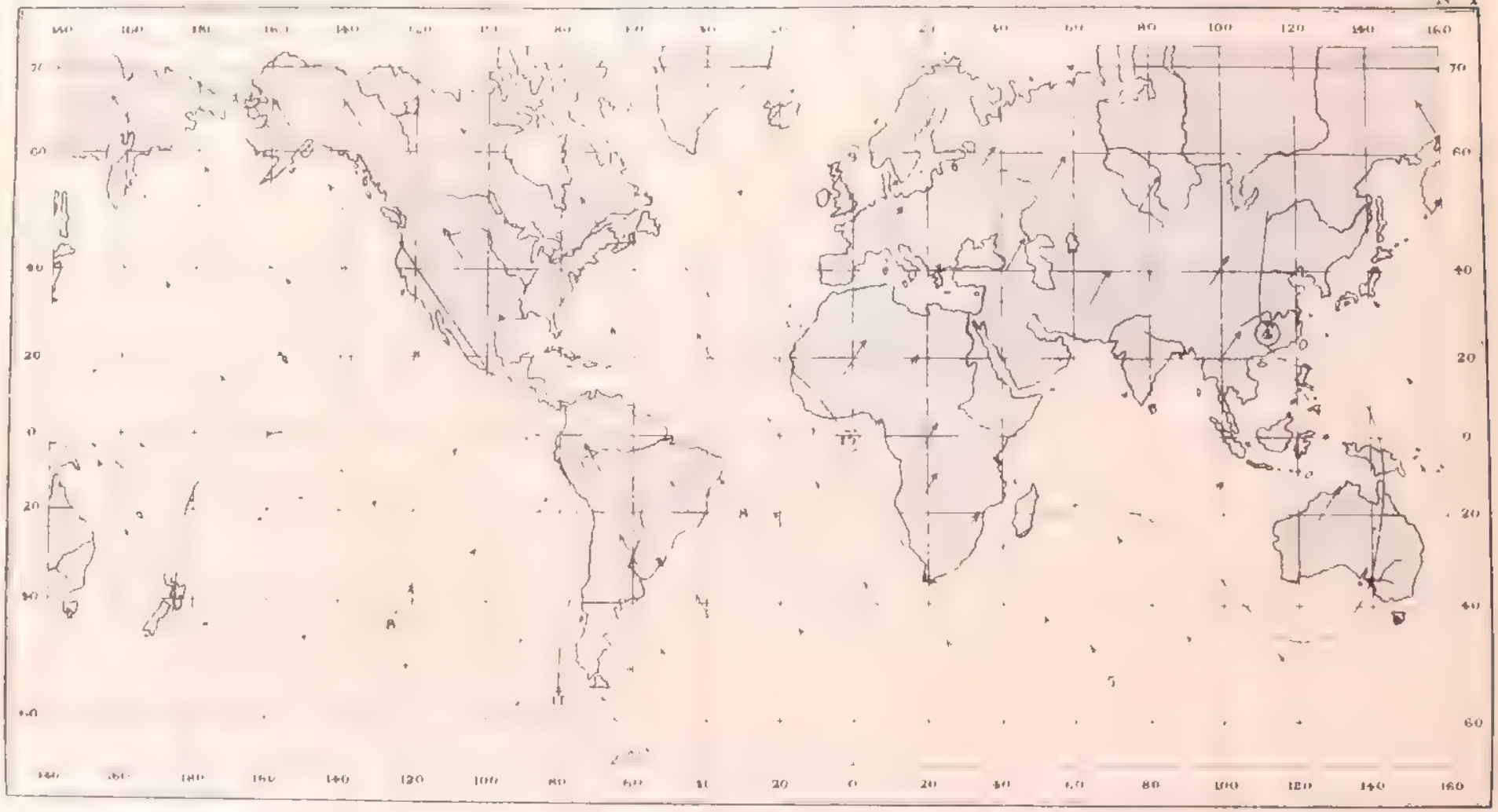
Happily, I am able to repeat the good news that the Norwegian, Captain Roald Amundsen, sailed in June last with the express object of making a magnetic survey of Ross's position and of the surrounding regions, in order to fix the position of the north magnetic pole. Furnished with suitable instruments of the latest pattern, he proposes to continue his investigations until 1905, when we may look for his return and the fulfilment of our hopes.

As far as we can now see, the south magnetic pole cannot be

MAP SHOWING

THE APPROXIMATE DISTRIBUTION OF THE SECULAR CHANGE IN THE MAGNETIC DECLINATION OR VARIATION EPOCH 1840-1880

N° 1



EXPLANATION

approached very nearly by the traveller, and we can only lay siege to it by observing at stations some distance off but encircling it. We have our own expedition on one side of it, and now with the return of the *Gauss* to South Africa in June last, we have learnt that that vessel wintered in lat. 66° 2′ S., long. 89° 48′ E., a position on the opposite side of the supposed site of the magnetic pole to that of the *Discovery*. We may now pause to record our warm congratulations to Dr. von Drygalski and his companions on their safe return, accompanied by the welcome report that their expedition has proved successful.

In addition to the British and German expeditions, there are the Swedish expedition and the Scottish expedition. Therefore, with so many nationalities working in widely different localities surrounding it, we have every reason to expect that the position of the south magnetic pole will be determined.

The Secular Change.

When in the year 1600 Gilbert announced to the world that the earth is a great magnet, he believed it to be a stable magnet; and it was left to Gellibrand, some thirty-four years later, by his discovery of the annual change of the magnetic declination near London, to show that this could hardly be the case. Ever since then the remarkable and unceasing changes in the magnetism of the earth have been the subject of constant observation by magneticians and of investigation by some of the ablest philosophers in Europe and America. Year after year new data are amassed as to the changes going on in the distribution of the magnetism of the earth, but as yet we have been favoured by hypotheses only as to the causes of the wondrous changes which the magnetic needle records.

These hypotheses were at one time chiefly based upon a consideration of the secular change in the declination, but it is now certain that we must take into account the whole phenomena connected with the movements of the needle, if we are to arrive at any satisfactory result. Besides, it will not suffice to take our data solely from existing fixed observatories, however relatively well placed and equipped, and valuable as they certainly are, for it now appears that the secular change is partly dependent upon locality, and that even at places not many miles apart differences in results unaccounted for by distance have been obtained.

The tendency of observation is increasingly to show that the secular change of the magnetic elements is not a world-wide progress of the magnetic needle moving regularly in certain directions, as if solely caused by the regular rotation during a long series of years of the magnetic poles round the geographical poles, for if you examine Map No. 1,[1] showing the results of observations during the years 1840-80 as regards secular change, you will observe that there are local causes at work in certain regions, whilst in others there is rest, which must largely modify the effect of any polar rotation.

Allow me to explain further. The plain lines on Map No. 1 indicate

[1] Originally prepared by the author for the "Magnetical Results," H.M.S. *Challenger*.

approximate regions of no secular change in the declination, and the small arrows the general direction (not the amount) in which the north-seeking end of the horizontal needle was moving during those forty years. The foci of greatest change in the declination, with the approximate amount of annual change in the northern hemisphere, are shown in the German Ocean and NW. Alaska, in the southern hemisphere off the coast of Brazil, and in the South Pacific between New Zealand and Cape Horn. The two foci of greatest annual change in the dip are shown, one in the Gulf of Guinea where the north-seeking end of the needle was being repelled strongly upwards, the other on the west side of Tierra del Fuego, where the north-seeking end of the needle was being attracted strongly downwards.

It is remarkable that the lines of no change in the declination pass through the foci of greatest change in the dip. If the needle be repelled upwards, as at the Gulf of Guinea focus, it will be found to be moving to the eastward on the east side of the whole line of no change in the declination from the Cape of Good Hope to Labrador; to the westward on the west side. If the needle be attracted downwards, as at the Tierra del Fuego focus, it will be found moving to the westward on the east side of the whole line of no declination from that focus to near Vancouver Island; to the eastward on the west side.

A similar result may be seen in the line passing through a minor focus of the dip near Hong Kong.

Judging from analogy there should be another focus of change in the dip in lat. 70° N., long. 115° E., or about the position assigned to the Siberian focus of greatest force.

On Map No. 2 are shown lines of equal value of the declination—the red lines for the year 1880, the black lines for the year 1895. From these, when shown on a large scale, we may deduce the mean annual change which has taken place in the declination during the fifteen years elapsed.

In this map we are reminded of the different results we obtain in different localities, for if a line be drawn from Wellington in New Zealand past Cape York in Australia to Hong Kong, little or no change will be found in the neighbouring region since 1840. Again, the line of no change in the declination shown on Map No. 1 to be following much the same direction as the great mountain ranges on the west side of the American continent, has hardly moved for many years according to the observations available.

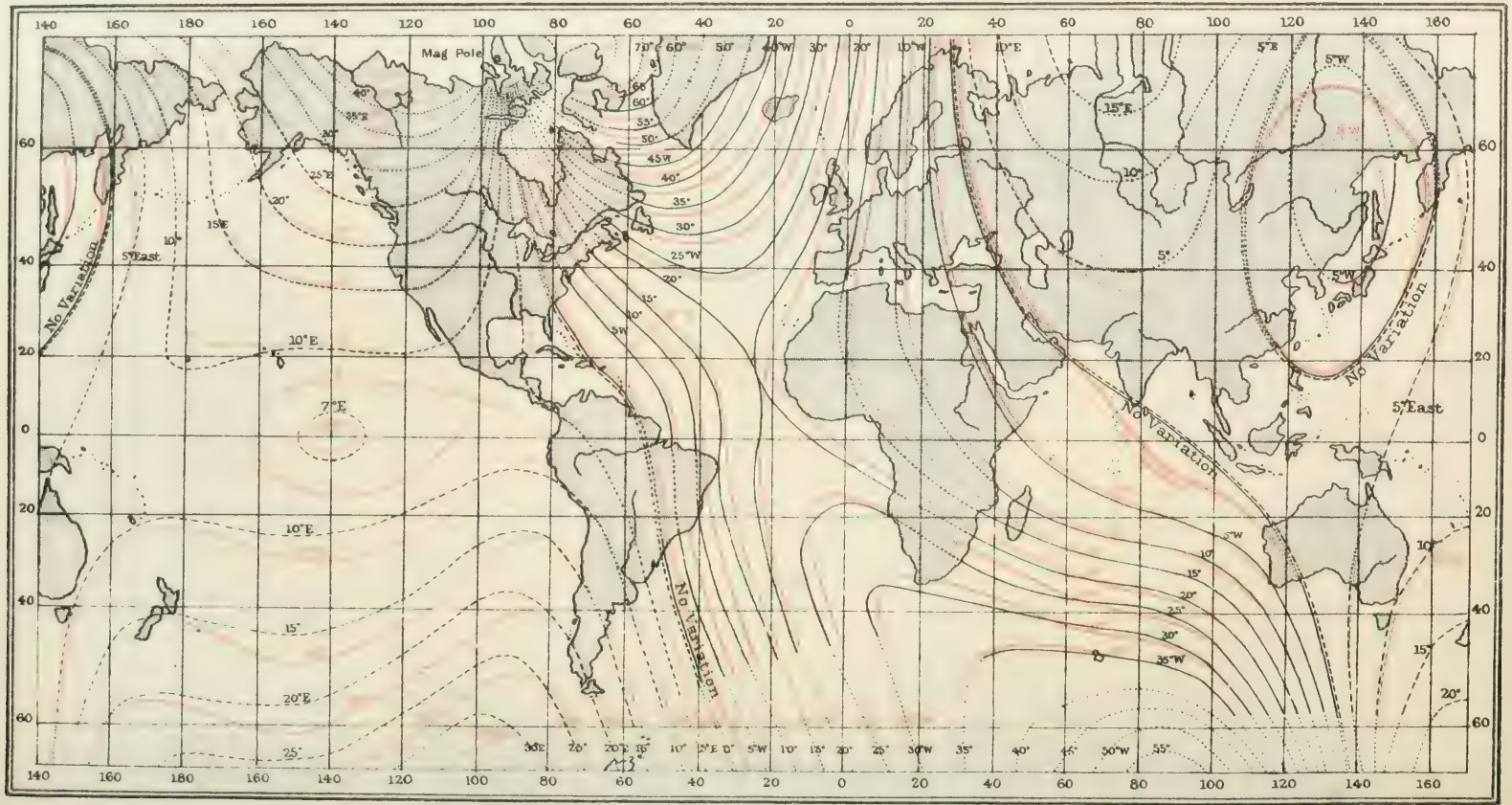
On the other hand, let us now turn to an example of the remarkable changes which may take place in the declination unexpectedly and locally. The island of Zanzibar and the east coast of Africa were constantly being visited by our surveying-ships and ships of war up to the year 1880, observations of the declination being made every year at Zanzibar during the epoch 1870-80. The results showed that from Capetown nearly to Cape Guardafui the annual change of that element hardly exceeded 1′.

During the succeeding years of 1890-91 observations were made by the Germans at Dar-es-Salaam and some other places on the neighbour-

MAP SHOWING LINES OF EQUAL MAGNETIC DECLINATION OR VARIATION

Showing the effects of 15 years of secular change

Nº 2



Red lines for epoch 1880. *Black lines for epoch 1895.*

ing coasts, with the result that the declination was found to be changing at first 3′ annually, and since that period it had reached 10′ to 12′ at Dar-es-Salaam. Subsequent observations at the latter place in 1896-98 confirmed the fact of the great change, and in addition our surveying-ship on the station, specially ordered to "swing" at different places in deep water off the coast, generally confirmed the results. It is remarkable that whilst such great changes should have taken place between Capetown and Cape Guardafui, Aden and the region about the straits of Bab-el-Mandeb seem to be comparatively unaffected.

Local Magnetic Disturbance.

In Map No. 2 normal lines of equal value of the declination are recorded, and as far as the greater part of the globe covered by water is concerned, we may accept them as undisturbed values, for we have yet to learn that there are any local magnetic disturbances of the needle in depths beyond 100 fathoms.

When, however, we come to the land, there is an increasing difficulty in finding districts of only a few miles in extent where the observed values of the magnetic elements at different stations therein do not differ more widely than they should if we considered only their relative position on the earth as a magnet. Take Rücker and Thorpe's maps of the British Isles and those of the United States, for example, where the lines of equal value are drawn in accordance with the observations, with the result that they form extraordinary loops and curves differing largely from the normal curves of calculation.

From among numerous examples of disturbance of the declination on land, two may be quoted. In the Rapakivi district, near Wiborg, a Russian surveying officer in the year 1890 observed a disturbance of 180°, or, in other words, the north point of his compass pointed due south. At Invercargill, in New Zealand, within a circle of 30 feet radius, a difference of 56° was found. Even on board ships in the same harbour different results are sometimes observed, as our training squadron found at Reikiavik in Iceland, and notably in our ships at Bermuda.

It is hardly necessary to add that the dip and force are often largely subject to like disturbance, but I do so in order to warn travellers and surveyors that observations in one position often convey but a partial truth; they should be supplemented by as many more as possible in the neighbourhood or district. Erroneous values of the secular change have also been published from the various observers not having occupied exactly the same spot, and even varied heights of the instrument from the ground may make a serious difference, as at Rapakivi before mentioned, and at Madeira, where the officers of the *Challenger* expedition found the dip at a foot above the ground to be 48° 46′ N.; at 3¼ feet above the ground 56° 18′ N. at the same spot.

All mountainous districts are specially open to suspicion of magnetic disturbance, and we know from comparison with normal observations at sea that those mountains standing out of the deep sea, which we call islands, are considerably so affected.

Magnetic Shoals.

The idea that the compasses of ships could be affected by the attraction of the neighbouring dry land, causing those ships to be unsuspectingly diverted from their correct course, was long a favourite theory of those who discussed the causes of shipwreck, but it was "a fond thing vainly invented." I can hardly say this idea is yet exploded, but from what has already been said about local magnetic disturbance on land, it is not a matter of surprise that similar sources of disturbance should exist in the land *under* the sea, for it has been found that in certain localities, in depths of water sufficient to float the largest ironclad, considerable disturbances are caused in the compasses of ships.

An area of remarkable disturbance having been reported as existing off Cossack, NW. Australia, H.M.S. *Penguin*, a surveying-ship provided with the necessary magnetic instruments, was sent by the Admiralty in 1891 to make a complete magnetic survey of the locality, with a view to ascertaining the facts and placing them on a scientific basis. An area of disturbance 3·5 miles long by 2 miles broad, with not less than 8 fathoms of water over it, was found lying in a NE. by E. and SW. by W. direction. At one position the disturbing force was sufficient to deflect the *Penguin*'s compass 56°; in another—the focus of principal disturbance—the dip on board was increased by 29°, and this at a distance of over 2 miles from the nearest visible land, upon which only a small disturbance of the dip was found.

This remarkable area of disturbance was then called a "Magnetic Shoal," a term which at first sight hardly appears to be applicable. We have, however, become familiar with the terms "ridge line, valley line, peak, and col," as applied to areas of magnetic disturbance on land; therefore I think we may conveniently designate areas of magnetic disturbance in land under the sea "Magnetic Shoals."

This year H.M. surveying-ship *Research* has examined and placed a magnetic shoal in East Loch Roag (Island of Lewis), but as all our surveying-ships are practically iron ships, it was impossible from observations on board to obtain the exact values of the disturbing forces prevailing in this shoal. The reason for this is that, although we may accurately measure the disturbing forces of the iron of the ship in deep water, directly she is placed over the shoal induction takes place, and we can no longer determine to what extent the observed disturbances are due to the ship's newly developed magnetism, or to what extent the shoal alone produces them.

We can, nevertheless, even in an iron ship, accurately *place* and show the dimensions of a magnetic shoal and the *direction* in which a ship's compass will be deflected in any part of it by compass observations only. Is it not, therefore, the duty of any ship meeting with such shoals to stop and fix their position?

The general law governing the distribution of magnetism on these magnetic shoals is that in the northern hemisphere the north point of the compass is drawn *towards* the focus of greatest dip; in the southern hemisphere it is *repelled*. The results at East Loch Roag proved an exception, the north point of the compass being *repelled*.

Terrestrial Magnetism and Geology.

I have already referred to the question of local magnetic disturbance as one of great importance in magnetic surveys. The causes of these disturbances were at one time a matter of opinion, but the evidence of the elaborate magnetic surveys I have alluded to, when compared with the geological maps of the same countries, points clearly to magnetic rocks as their chief origin.

Magnetic rocks may be present, but from their peculiar position fail to disturb the needle; but, on the other hand, as Rücker writes in his summary of the results of the great magnetic survey of the British Isles conducted by Thorpe and himself, "the magnet would be capable of detecting large masses of magnetic rock at a depth of several miles," a distance not yet attained by the science of the geologist.

Again, Dr. Rijckevorsel, in his survey of Holland for the epoch 1891, was convinced that "in some cases, in many perhaps, there must be a direct relation between geology and terrestrial magnetism, and that many of the magnetic features must be in some way determined by the geological structure of the underground."

During the years 1897-99 a magnetic survey was made of the Kaiser-stuhl, a mountainous district in the neighbourhood of Freiburg, in Baden, by Dr. G. Meyer. Exact topographical and geological surveys had been previously made, and the object of the magnetic survey was to show how far the magnetic disturbances of the needle were connected with geological conformations. Here, again, it was found that the magnetic and geological features of the district showed considerable agreement, basaltic rocks being the origin of the disturbance. This was not all, for in the level country adjacent to the Rhine and near Breisach unsuspected masses of basalt were found by the agency of the magnetic needle.

More recently we find our naval officers in H.M.S. *Penguin*, with a complete outfit of magnetic instruments, making a magnetic survey of Funafuti atoll and assisting the geologist by pointing out, by means of the observed disturbance of the needle, the probable positions in the lagoon in which rock would be most accessible to their boring apparatus.

Leaving the geologist and the magnetician to work in harmony for their common weal, let us turn to some other aspects of the good work already accomplished and to be accomplished by magnetic observers.

Magnetic Charts.

Of the valuable work of the several fixed magnetic observatories of the world, I may remark that they are constantly recording the never-ceasing movements of the needle, the key to many mysteries to science existing in the world and external to it, but of which we have not yet learnt the use. Unfortunately many of these once fixed observatories have become travellers to positions where the earth can carry on its work on the needle undisturbed by electric trams and railways which have sprung up near them, and it is to be hoped they will find rest there for many years to come.

Of the forty-two observatories which publish the values of the magnetic elements obtained there, thirty-two are situated northward of the parallel of 30° N., and only four in south latitude; and it is a grief to magneticians that so important a position as Capetown or its neighbourhood does not make an additional fixed magnetic observatory of the first order.

Thus, as far as our present question of magnetic charts and their compilation is concerned, the observatories do not contribute largely, but we should be very grateful to them for the accurate observations of the secular change they provide which are so difficult to obtain elsewhere.

Of the value of magnetic charts for different epochs I have much to say, as they are required for purely scientific inquiry as well as for practical uses. It is only by their means that we can really compare the enormous changes which take place in the magnetism of the globe as a whole; they are useful to the miner, but considerably more so to the seaman. Had it not been for the charts compiled from the results of the untiring labours of travellers by land and observers at sea in the field of terrestrial magnetism during the last century, not only would science have been miserably poorer, but it is not too much to say that the modern iron or steel steamship traversing the ocean on the darkest night at great speed would have been almost an impossibility, whereas with their aid the modern navigators can drive their ships at a speed of 26·5 statute miles an hour with comparative confidence, even when neither sun, moon, nor stars are appearing.

Of the large number of travellers by sea, including those who embark with the purpose of increasing our geographical knowledge of distant lands and busying themselves with most useful inquiries into the geology, botany, zoology, and meteorology of the regions they visit, few realise that when they set foot on board ship (for all ships are now constructed of iron or steel) they are living inside a magnet. Truly a magnet, having become one by the inductive action of that great parent magnet —the Earth.

How fares the compass on board those magnets, the ships, that instrument so indispensable to navigation, which Victor Hugo has forcibly called "the soul of the ship," and of which it has been written,

> "A rusted nail, placed near the faithful compass,
> Will sway it from the truth, and wreck an argosy."

And if so small a thing as an iron nail be a danger, what are we to say to the iron ship? Let us for a moment consider this important matter.

If the nature of the whole of the iron or steel used in construction of ships were such as to become permanently magnetic, their navigation would be much simplified, as our knowledge of terrestrial magnetism would enable us to provide correctors for any disturbing effects of such iron on the compass, which would then point correctly. But ships, taken as a whole, are generally more or less unstable magnets, and constantly subject to change, not only on change of geographical position,

but also of direction of the ship's head with regard to the magnetic meridian. Thus a ship steering on an easterly course may be temporarily magnetised to a certain extent, but on reversing the ship's course to west she would after a time become temporarily magnetised to the same amount, but in the opposite direction, the north point of the compass being attracted in each case to that side of the ship which is southernmost.

Shortly, we may define the action of the earth's magnetism on the iron of a ship as follows: The earth being surrounded by a magnetic field of force differing greatly in intensity and direction in the regions from the North Pole to the Equator and the Equator to the South Pole, the ship's magnetic condition is largely dependent upon the direction of her head whilst building and the part of that field she occupied at the time; partly upon her position in the magnetic field she traverses at any given time during a voyage.

For the reasons I have given, magnetic charts are a necessity for practical purposes and in the following order of value. That of the magnetic declination of variation which is constantly in use, especially in such parts of the world as the St. Lawrence and the approaches to the English Channel, where the declination changes very rapidly as the ship proceeds on her course. Next, that of the dip and force, which are not only immediately useful when correcting the ship's compass, but are required in the analysis of a ship's magnetism both as regards present knowledge and future improvements in placing compasses on board.

If astronomers have for a very long time been able to publish for several years in advance exact data concerning the heavenly bodies, is it too much to hope that magneticians will before long also be able to publish correct magnetic charts to cover several years in advance of any present epoch? If this is to be done within reasonable time there must be a long pull, a strong pull, and a pull all together of magnetic observers in all lands, and accumulated data must also be discussed.

On Magnetic Instruments for Travellers.

Travellers in unsurveyed countries, if properly instructed and equipped, can do good service to science by observing the three magnetic elements of declination, inclination or dip, and force at as many stations as circumstances will permit; hence the following remarks.

For the purpose of making the most exact magnetic survey the best equipment of instruments consists of the well-known unifilar magnetometer, with fittings for observing the declination, and a Barrow's dip circle. To some travellers these instruments might be found too bulky, and in some regions too delicate as well as heavy to carry.

Of suitable instruments made abroad, those used by M. Moureaux in his survey of France may be mentioned, as they are of similar type, but much smaller and lighter than the instruments above mentioned.

Another form of instrument, called an L.C. instrument, for observing both the inclination and total force, is shown in the instrument before you. Originally designed for observations on board ships at sea where

the ordinary magnetic instruments are unmanageable, it has also been found to give satisfactory results in a land survey, where greater accuracy is expected than at sea. Thus, during a series of observations extending from the north side of Lake Superior to the southern part of Texas last year, comparisons were made between the results obtained with an L.C. instrument and those of the regular unifilar magnetometer and dip circle, when the agreement was found satisfactory.

I am therefore of the opinion that a traveller furnished with a theodolite for land-surveying purposes, but fitted with a reversible magnetic needle, can at any time he observes a true bearing obtain a trustworthy value of the declination. Dismounting the theodolite from his tripod, the latter will serve for mounting an L.C. instrument with which to observe the inclination and force. Thus, by adding to his ordinary equipment an instrument weighing in its box about 21 lb., he can obtain valuable contributions to terrestrial magnetism, and at the same time give useful assistance to geological investigations.

Concluding Remarks.

Although a great subject like terrestrial magnetism, even to exhibit our present knowledge of the science, cannot be brought within the compass of an address—for it requires a treatise of many pages—I have brought some of the broad features of it before the Section in order to show its connection with Geography.

I also entertain the hope that geographers will become more interested in a subject so important to pure science and in its practical applications, and that it will become an additional subject to the instruction which travellers can now obtain under the auspices of the Royal Geographical Society in geology, botany, zoology, meteorology, and surveying.

There is a wide field open to observers, and where results often depend so much upon locality we require to explore more and more with the magnetic needle. To look over the great oceans and think how little is being done for terrestrial magnetism is a great matter for regret. Yet even there we may begin to be hopeful, for the United States Coast and Geodetic Survey authorities are making arrangements to fit out its vessels with the necessary instruments for determining the magnetic elements at sea.

We wish them all success; but I must again remind you that although we cannot compel observers to start, there is room for them and to spare.

I would fain make some remarks on the prevailing ignorance of sound geography in many quarters, and on the defective methods of teaching the science; but I feel that the subject is placed in very able hands, and will be fully discussed elsewhere during the present meeting.

MEETING OF THE BRITISH ASSOCIATION.

THE seventy-third meeting of the British Association opened at Southport on Wednesday, September 9, when the opening address on "The Influence of Brain-power on History" was delivered by Sir Norman Lockyer, President of the Association. The various sections met on the following morning, and in Section E (Geography) Captain Creak delivered his presidential address, which we print in full in this issue. In moving a vote of thanks to Captain Creak, Dr. H. R. Mill spoke of the great results in regard to terrestrial magnetism which are hoped for from the British National Antarctic Expedition, whose very perfect magnetic equipment was largely due to Captain Creak.

Thereafter Dr. TEMPEST ANDERSON gave an interesting description of phenomena attending the recent volcanic eruptions in the West Indies. The lecture was illustrated by a series of very beautiful photographs showing the terrible devastation and extraordinary changes wrought by the eruptions.

In the afternoon a paper was read by Mr. E. D. MOREL on "The Economic Development of West Africa." Mr. Morel said that although West African affairs are engaging more and more attention, the public as a whole continues to display a curious indifference to that part of the world. Yet there are urgent reasons why a manufacturing nation like ours should show keener interest in one of the greatest raw material-producing countries in the world, of which we possess some 70,000 square miles, inhabited by 30,000,000 people. The author of the paper protests against the indifference of the public: the extent of British commercial interests in West Africa are ignored by most, and the future potentialities of the country are insufficiently appreciated. The chief factor which determined the Powers to assume the liabilities they have in tropical Africa was due to the belief that raw material is necessary to an industrial and manufacturing nation, and that each nation must find new markets for the consumption of home manufactures, markets which will pay for such manufactures in raw material. It follows, therefore, that the economic development of tropical Africa is the principal aim which each Power has in view. How can that economic development be best pursued in a manner profitable to the people of Europe and to the people of Africa? If it is to be permanently successful it must be profitable to both.

The paper goes on to point out that two political conceptions—utterly divergent and antagonistic, yet both alike concerned with the economical development of tropical Africa, and therefore both alike arising from the cardinal factor which led to the partition of tropical Africa among the Powers—are before the world. The adoption of one or the other conception will decide the future of European effort in the black man's country. The two conceptions are defined as Coercion and Commerce: the former is characterised as a revival in aggravated form of the old culture system of the Dutch East Indies, which had to be abandoned owing to the ruin and exhaustion it brought with it. This

system is at present in operation in a large portion of tropical Africa. It is based upon the repudiation, or rather the ignoring, of native rights of land tenure; upon the definition of all land not actually built over or cultivated for food-stuffs as "vacant"; and upon the appropriation of all such land and the produce yielded by it. It tends towards the enslavement of whole peoples, and brings inevitable ruin in its train. Arguments are adduced to show that, apart from its moral side, this conception is antagonistic to the development of all legitimate European aims in tropical Africa, and that if it is morally pernicious it is also practically short-sighted and injurious, and should be resisted to the uttermost.

The other conception has, the author contends, notwithstanding many material obstacles, produced results which are obvious and visible to all. It is based upon the recognition that the inherent rights of a native of tropical Africa to his land and the produce thereof are the necessary accompaniments of all successful and permanent development work in the interests both of the European and the negro. The commercial instincts of the negro are notorious, his adaptability remarkable; the theory that he will not work is untenable in face of the positive results of his labours in the millions of pounds' worth of produce shipped home annually to Europe from West Africa. He merely requires instruction and guidance to prevent wastage and destruction of economic products due to want of knowledge in the preparation and collection of the raw material. An urgent necessity is the careful study of native land tenure as an important factor in economic development, the theory of "vacant" lands being often misleading and open to grave abuses.

The paper then discusses the best means of improving native industries and helping the native to construct new ones, laying particular stress upon the great importance of extending the growth of cotton in, and promoting its export from, the tropical African provinces of the Empire. Reference having been made to various measures which might with advantage be taken by government to secure these ends, the opinion is expressed that the only right and practical ideal which should govern European action in tropical Africa (which is, and must always remain, a black man's country, where the European cannot colonise and can only supervise) is to teach the native to take pride in his property; to guarantee him from molestation in his ownership of his property; to assist him in developing the raw products his fertile soil yields for his own advantage and ours: to make it clear to him that we look upon him, not as a fool, still less as a brute, but as a partner in a great undertaking which, if properly conducted, will confer lasting benefit upon his race and the white over-lords who have established themselves in his midst.

Among papers of geographical interest read in other sections, special reference should be made to several in Section C (Geology). Professor W. W. Watts's presidential address dealt with "The Functions of Geology in Education and Practical Life." The following extracts bear upon the connection between geography and geology:—

"A geological basis for the classification and grouping of surface-features is the only one which is likely to be satisfactory in the end, because it is the only one founded on a definite natural principle, the relation of cause to effect. It is not

without good reason that the topographic and geological surveys of the United States are combined under one management, and nowhere else are the topographic results more accurate and satisfactory. Landscape is traced back to its ultimate source, and consequently sketched in with more feeling for the country and greater accuracy of knowledge than would otherwise be possible. Geologists were among the first to cry out for increasing accuracy and detail in our government maps, and they have consistently made the utmost use of the best of these maps as fast as they appeared. With the publication of each type of map, hachured, contoured, six-inch, twenty-five inch, the value and accuracy of geological mapping has advanced step by step. Wherever the topography is better delineated than usual, the facilities are greater for accurate geological work, and the best geological maps, and those in greatest demand, are always those based on the most minute and detailed topographic work. On the other hand, geologists are training up a class of men who can read and interpret the inner meaning of these maps, and make the fullest use of the splendid facilities given by the minute accuracy of the ordnance work.

In dealing with the relationship of Geology to Geography, geologists are frequently charged with claiming too much. On this point at least, however, there can be no difference of opinion, that the majority of geological surveyors and unofficial investigators have kept their eyes open to this relationship, and have often contributed new explanations to old problems. They have been compelled to observe, and often to explain, surface-features before making use of them in their own mapping, and in doing so have often hit upon new principles. It is hardly needful to mention such examples as Ramsay's great conception of plains of marine denudation, Whitaker's convincing memoir on sub-aërial denudation, Jukes's explanation of the laws of river adjustment, Gilbert's scientific essay on erosion, Heim's demonstration of the share taken by earth-movement in the modelling of landscape features, and the exceedingly valuable proofs of the relation of human settlement and movement to underground structure, worked out with such skill and diligence by Topley in his masterly memoir on the Weald—the jumping-off place, if I may so term it, of the new geography.

No one is more pleased than geologists that geographers have ceased to draw their knowledge of causation solely from history, and that they have turned their attention to the dependence and reaction of mankind on nature as well. But while hoping that geographers will continue to study, so far as they logically can, the relationship of plants, animals, and mankind to the solid framework of the globe on which they live, we must draw the line at the invention of new geological hypotheses to explain geographic difficulties on no better evidence than that furnished by the difficulties themselves; on the other hand, we must insist that each new geological principle must take its place amongst geographic explanations as soon as it is freely admitted to be based on a sound substratum of fact.

I must confine myself to a few instances of what I mean. Mr. Marr's geological work on the origin of lake-basins has led to some remarkable and unexpected conclusions with regard to the history and origin of the drainage of the Lake district. Some of the very difficult questions raised by the physical geography of the North Riding of Yorkshire have received a new explanation from the researches of Professor Kendall and Mr. Dwerryhouse, an explanation which is the outcome of purely geological methods of observation of geological materials. Again, the simple geological interpretation of a well-known unconformity between Archæan and Triassic rocks has made it extremely probable that many of the present landscapes, not only in the Midlands but elsewhere, may be really fossil

landscapes, of great antiquity and due to causes quite different from those in operation there at the present day. In mountain regions, too, it can only be by geological observation that we shall ever determine what has been the precise direct share of earth-movement in the production of surface relief. Such examples seem to indicate that many of the principles must be of geological origin but of geographic application."

In the same section Mr. J. LOMAS read an interesting paper on the geology of the country round Southport. Mr. Lomas dwelt especially on the low platform which fringes the sea. It varies in height from 9 feet to 20 feet above Ordnance datum, and is fringed on the seaward side by sandhills rising to an elevation of from 50 feet to 90 feet. On the north the broad estuary of the Ribble separates this plain from a similar platform known as the Fylde district, and the Mersey on the south cuts off another fragment which forms the north end of the Wirral. The whole of this plain was the gift of the Irish Sea glacier, which formerly overrode the district, the solid rocks only reaching the surface in the case of a few islands, while the bulk is below sea-level.

With regard to the deposits on this plain, Mr. Lomas said that the surface of the boulder clay was very uneven, and in the hollows, meres had been formed. Many of these had since been filled with peat, in which tree trunks, both prone and erect, were found enclosed. In all cases they either drained eastwards now or formerly did so. Borings in the peat showed that they often extended below sea-level, and there must have existed barriers which prevented the waters from reaching the Irish Sea. It had been estimated that the coasts in the neighbourhood were being eroded, in some places at the rate of five yards a year; so that four hundred years ago the land would extend more than a mile seawards, and if the same rate of waste had obtained since the glacial period there would be a land of meres and mosses extending as far as the Isle of Man. It was possible that the Irish elk found in the Isle of Man crossed by this lost land. Along the coast meres could be seen in all stages of decay. Immediately to the east of Southport was Martin Mere, only separated from the sea by a narrow bank at Crossens. At the Alt mouth, at Leasowe, in Cheshire, and in other places the ancient meres had been cut in two by the sea, and we had peat and tree trunks on the coast below high-water level. These were usually spoken of as "submerged forests," and their occurrence in the places mentioned might indicate a lowering of the surface of the land since the trees grew. The present mouths of the Mersey, Alt, Douglas, and Ribble had all been cut through ancient meres, and as there was evidence that these formerly drained to the east it was probable that the breaching of the meres had resulted in a reversal of flow since glacial times, and the present mouths were of comparatively recent date. The sandhills on the coast only occurred in districts adjacent to rivers. It was probable that they owed their origin to the material brought down by the rivers, forming a bank of sand in the slack water at each side of their channels. These banks drying at low-water, the sand had then been blown inland by the prevailing south-westerly winds. No duns existed in this district four

hundred years ago, and they were probably subsequent to and resulted from the reversal of the drainage of the Mersey and Ribble.

Mr. Harold Brodrick, M.A., then read a paper in the same section on "Martin Mere," referred to by Mr. Lomas in the former paper. He said that Martin Mere, a lake situated inland of and to the north-east of Southport, was at the end of the sixteenth century about four miles long by two in width, its length extending from Crossens to Rufford. It was one of a number of lakes which formerly existed in this district, such as the lake on the site of Chat Moss and others in the Wirral Peninsula. The district under consideration seemed to have formed a portion either of a large lake basin, which stretched seawards, or of an estuary, as a deposit of grey clay was found underlying the western portion of the mere; the lacustrine or estuarine character of this clay was not at present fully determined. Subsequent to this deposit a good drainage system came into existence, and a forest sprang up consisting of gigantic oaks and Scotch firs, the roots of which trees penetrated through the grey clay, and in some cases imbedded themselves in the underlying boulder-clay. This forest covered a considerable area of South-West Lancashire and the Wirral Peninsula, and extended seawards of the present coast-line. The drainage of this district became obstructed by a bank of tidal alluvium at Crossens, and a lake was formed, killing the trees, which fell mostly pointing in a north-easterly direction. The old basin was filled with peat. The greatest depth of the peat so far ascertained was 19 feet. Imbedded within a few feet of the surface fifteen canoes, each hollowed out of a single tree trunk, had been found. In 1692 the first artificial drainage works were commenced, and consisted of a canal, cut through the banked alluvium at Crossens, and flood-gates. It was not until about 1850 that the lake was efficiently drained. Previous to that date the area was frequently flooded, partly owing to the blocking of the flood-gates by sand, partly to incursions of the sea, and partly to floods from the Douglas. The present area of the old lake was now below the high-water mark of spring-tides, which had been known within living memory to flow up as far as Berry House.

On Friday the proceedings of Section E were opened by a paper by Professor O. Pettersson on "The Influence of Ice-Melting upon Oceanic Circulation." We give Professor Pettersson's abstract of his paper in full, also a note on an experiment by Mr. J. W. Sandström, of which Professor Pettersson gave a brief account.

The Influence of Ice-melting upon Oceanic Circulation.

By Professor O. Pettersson.

The circulation of oceanic waters has been ascribed partly to physical causes, such as the heating of surface waters in tropical and the cooling in polar regions, partly to mechanical causes, such as the influence of the prevailing winds. The latter is at present regarded as the chief motive power of the currents of the sea. In either case the *vis movendi* must be the effect of a thermodynamic cycle of the free heat in the atmosphere or in the hydrosphere. On the mechanical hypothesis

it is obvious that the primary effect is the generation of surface-currents (wind-currents) of great intensity, and that the intensity of motion must decrease with the depth. The general conviction at present is that the movement of the bottom waters of the ocean is extremely slow (*vide* G. Schott's description of the results of the German Valdivia expedition).

In 1878 the author pointed out that a great—and probably the greatest—part of the oceanic current system must be due to another cause, viz. the thermodynamic cycle of latent heat, consisting in the formation of ice in polar regions and the melting of ice in sea-water at lower latitudes. In Petermann's *Mitteilungen*, 1900, Heft I. and II., he calculated the energy generated by the melting of ice in the sea between Iceland and Jan Mayen to be about 400,000 horse-power, which energy is employed in accelerating the movement of the waters of the East Iceland polar current, which makes its way from the sea between Iceland and Jan Mayen towards the Färoes, there to dip under the current of Atlantic water which sets in between the Shetlands and the Faroes, and ultimately vanishes into the Atlantic depths in the shape of a submarine waterfall over the Iceland-Färoe and W. Thomson bank. The energy set free on the melting of ice in sea-water is expended in raising the water from the submerged part of the ice to the surface, and may be likened to a waterfall where the water, instead of descending, arises from below to the surface. The heat necessary for this melting is supplied from undercurrents of warm Atlantic water, which exist wherever the melting of ice goes on in the ocean. One part (in the case referred to about $\frac{1}{15}$) of this warmer and salter water mixes with the ice-water and forms the polar surface-current, while the greater part (here about $\frac{14}{15}$) is cooled to a temperature approaching the temperature of equilibrium between ice and salt water, and sinks to the bottom, there to form the layer of cold water which is known to exist in all oceans. The temperature and the salinity of this bottom water depend upon the relation between the quantity of ice which is melted and the amount of warm water supplied by the undercurrent. In the Atlantic Ocean the temperature is a little below or above +2°, which shows that the warm water here is in excess of the ice. In the Norwegian Sea the bottom temperature is about −1·4° C., *which is the lowest existing on the globe*. This shows that the warm water supplied by the Atlantic current is just sufficient to melt the ice which is brought down along the coast of Greenland by the polar current. It is inferred from this that the state of this part of the sea is in a very unstable equilibrium, which may account for the instability of the climate of the northern countries of Europe and the great variations in the extension of the ice in this sea. In the Polar Sea we meet with the startling fact, discovered by Nansen, that the bottom temperature is *higher* than in the Norwegian Sea, or above −0·9° C. This is explained by the fact that the ice in the Polar Sea floats in a layer of cold water diluted by the admixture of river-water from Siberia. Thereby the access to the ice of the warm and salt undercurrent, which Nansen discovered at about 200 m. depth, is more or less prevented. The ice-melting in the Polar Sea thereby becomes less intense, the surface of the sea is filled with ice-floes and pack-ice, which must be carried out into the Norwegian Sea or the Atlantic in order to melt. Therefore the cooled bottom layer has a higher salinity and temperature than in the adjacent Norwegian Sea.

The influence of the thermodynamic cycle of latent heat upon oceanic circulation is characterised by the following circumstances :—

1. The seat of the accelerating force is *localised* in the meeting-places of the ice-currents of polar origin with warm currents. The most important of these

places are the sea between Iceland and Jan Mayen, W. of Spitzbergen, SE. of Newfoundland, and the ice girdle encircling the Antarctic Sea.

2. In all such places warm undercurrents are found to exist under the ice. The melting process is maintained chiefly at the cost of the heat stored up in the waters of the undercurrent. The system of currents and undercurrents of the Norwegian Sea is represented on a chart prepared by the author.

3. The warm water of the undercurrent, which in the northern hemisphere is denoted by the name of "Atlantic" water (*alias* Gulf Stream water) is modified by its contact with the ice into "Arctic" water. One part of this Arctic water consists of Atlantic water diluted with ice-water. This kind of water rises to the surface and contributes to the maintenance of the polar currents. The other and greater part consists of Atlantic water, which has given up its surplus of heat and sunk to the bottom, there to form the great cold bottom layer of the oceans.

4. The warm undercurrents always follow the trend of the deepest isobathic lines, while the ice-currents only exist over shallow parts of the sea. As soon as an ice-current leaves the coast-bank and takes its way over a deep part of the ocean, its ice is exposed to melting by the warm undercurrent, which is attracted by the ice and maintained by the energy set free at the melting process.

5. The above-mentioned chart shows a remarkable example of how north-going warm currents and undercurrents are deviated to the west in the Norwegian Sea, in spite of the powerful influence of the earth's rotation.

6. The metamorphosis of Atlantic water into Arctic water involves also a biological change. The foraminifers, etc., of the Atlantic die out (as already shown by Sir J. Murray) in contact with the cold water and sink to the bottom, there to form calcareous deposits. Consequently the course of the warm undercurrents can be traced up to the highest latitudes by a surplus of CaO in the bottom sediments.

7. The author's experiments with exact measurements in the Skagerack and the Baltic show that the motion of the deeper layers there is by no means insignificant or slow, as it is judged to be by the advocates of the "wind-theory," but is, as a rule, *stronger* than that of the surface water. How far this holds with regard to the deeper parts of the oceans remains to be investigated. Therefore current measurements in the Atlantic at depths of 800-4000 m. are a pressing desideratum in oceanography.

8. As the accumulation of polar ice varies with the season, and is influenced by terrestrial (meteorological) as well as cosmical phenomena (radiation, etc.), it is evident that the current system set in action by the cycle of latent heat must show periodical variations with the seasons and also periodical or non-periodical variations of longer duration. Are there any indications of such variations in the movement of the undermost layers of the sea? The author's experience is that there are such indications, and this discovery has led him to propound the present theory.

9. The Antarctic Ocean presents the grandest example of ice-melting and of variations in ice-melting. It must be borne in mind that the energy liberated by ice-melting in the ocean is proportional to the depth of the submerged part of the ice. From an iceberg 500 m. in depth the melting of one kilogram of ice will produce an amount of work equal to 7 kilogram metres. Great "outbursts" of icebergs from the Antarctic are known to happen from time to time (Russell). Such outbursts, which carry icebergs down to low latitudes in the Indian Ocean, may exercise influence upon the climate of India, Australia, etc., as thereby part of the warm area of the ocean from which the water evaporates, which ultimately

falls as monsoon rain upon the coasts of these countries, may be encroached upon by cold polar water. It is a matter worth notice that the last great "outburst" from the Antarctic and the last great droughts of India fall within the same period of years (1891-98). By means of regular surface observations on board of liners crossing the Indian Ocean, and a few series of deep soundings along the 60th and 100th meridian, such yearly variations in the hydrographic state of the Indian Ocean as can be of meteorological interest might be ascertained.

In order to put the theory of the influence of ice-melting to a test, the author has carried out a series of experiments so arranged as to correspond as nearly as possible to the natural conditions of the Norwegian Sea, and has compared the results with the actual results of the Norwegian and Swedish hydrographic research in this part of the ocean in 1900. A description of the last experiment of the series, carried out by Mr. J. W. Sandström, assisted by Miss A. Palmquist, is given in the next paper.

An Experiment on the Melting of Ice in Salt Water.

By J. W. Sandstrom.

At the request of Professor Pettersson, the author repeated one of the ice-melting experiments mentioned in the preceding paper on a larger scale in the Central Laboratory for Oceanic Research at Christiania, Professor Nansen kindly placing at his disposal the large tank, 3·5 metres in length by 0·4 metre in height and 0·7 metre broad, which had served in his own investigations. This tank was filled to a depth of 35 cm. with salt water at 7° C. and 30 per cent. salinity. The tank was divided into two compartments by a partition 30 cm. high. Above this wall there was free communication between the water in the two compartments.

In the right compartment (which represents the Norwegian Sea) a rectangular ice block 50 kilogrammes in weight was introduced. While melting it assumed a very peculiar shape.

In the left compartment (Atlantic) an extra current was set going, carrying twelve litres per hour of water of the same salinity and temperature in and out of the vessel at a constant level. The movement of the water in the other compartment was studied by means of thin jets of $KaMnO_4$ solution, which were made to ascend from capillary tubes at the bottom. The deflection from the vertical of these jets was measured every ten minutes. Thus a good estimate of the velocity at different levels was obtained.

Before the introduction of the ice block in the right compartment the jets indicated an almost entire absence of movement of the waters of this compartment, although the extra current was circulating constantly in the other (Atlantic). With the introduction of the ice conditions changed. Three different currents could be discerned to the right of the partition wall, which represented the Färoe-Shetland or Färoe-Iceland ridge. From the left (Atlantic) an undercurrent was attracted towards the under-side of the ice, where it reached its maximum velocity of 0·23 cm. per second. From the farthermost side of the ice block, where the undercurrent impinged, cold diluted water arose to the surface and formed an outgoing "polar" current, the maximum velocity of which was found to be 0·03 cm. per second. From the ice cold and dense water descended to the bottom, where it formed a powerful outgoing current with a maximum velocity of 0·14 cm. per second. The bottom current had an upward tendency near the partition wall, over which it flowed into the Atlantic compartment. All measurements were

made after the conditions had become established, which was found to be the case after two hours. The volume of water carried by the undercurrent towards the ice was about twenty-seven times the volume carried by the returning bottom current and about twelve times greater than that of the surface current.

By observation of the motion of small particles of insoluble matter held in suspension by the water, the current lines in the middle vertical section of the tank were constructed.

Accurate observations of salinity and temperature at all depths were made by the chemist of the Swedish Hydrographical-Biological Commission (Miss Palmquist) and the density *in situ* of the water computed from Knudsen's tables. From these data the accelerating forces of the circulation were calculated according to V. Bjerknes, "Ueber einen hydrodynamischen Fundamentalsatz und seine Anwendung besonders auf die Mechanik der Atmosphäre und des Weltmeeres." The result was to show that the accelerating forces counteracted the circulation in the part of the right compartment most remote from the ice, while they aided the circulation in the neighbourhood of the ice. The aiding forces (=0·57 c.g.s. solenoids), however, exceeded those contracting (=0·18 c.g.s. solenoids), the difference (=0·39 c.g.s. solenoids) being the two acting forces.

The same remarkable distribution of forces is found to exist in the sea. In the longitudinal section of the Norwegian Sea from July and August 1900, constructed by Professor Pettersson, there are 10,050 c.g.s. solenoids between lat. 77° and 70° in aid of the circulation and 3025 c.g.s. solenoids counteracting this circulation between lat. 70° and 64°. The accelerating force which maintains the oceanic circulation in this section of the Norwegian Sea thus is equal to 7025 c.g.s. solenoids. The seat of these forces is the immediate neighbourhood of the ice.

Putting aside the influence of the earth's rotation and of friction, we find that this set of forces is sufficient to increase the velocity of the water by 14 cm. per second in one week.

Subsequently Dr. VAUGHAN CORNISH presented the Annual Report of the Committee upon Terrestrial Surface Waves. In regard to the variability of the Severn Bore, Dr. Cornish said:—

This phenomenon is subject to apparently capricious variations in addition to that which depends upon the varying aptitude of the tide. Visiting Newnham-on-Severn on the occasion of one of the highest tides of an early autumn, I found that there was practically no bore, although in springtime I had seen a good one with a smaller tide. The fishermen opined that the sands between Awre and Frampton, a few miles down the river, had shifted in some way, which would be found to account for the failure of the bore at Newnham. Accordingly at the next succeeding tide I took up a post of observation at Hock Crib, where I could command a view over the extensive sands in the broad straight stretch towards Severn Bridge, which constitutes the commencement of the proper estuary, as well as of the last bend of the winding channel of the river proper looking towards Newnham. The main stream of the river had established itself in a channel somewhat near the right bank, and up this the "first of the flood" came with a good "head" to it, the bore appearing as a crested breaking wave stretching from quite across the low-tide channel. It thus continued until it reached a point close to Hock Cliff, at the head of another channel which skirts the concave left bank, passing Frampton. From the position now reached by the incoming flood, water now poured *back* into this channel, the further advance of the tide up

stream being stopped. Presently the back-flowing stream met another coming up the Frampton Channel, and the turbulent waters then began to spread over the large expanse of sand intervening between the two channels. Not until these were nearly covered did any perceptible rise of tide make its way up the river channel towards Newnham. The total rise of the tide is unaffected by this course of events, but the "head" which the flood had gathered is lost and the bore is spoilt. It was pointed out in a paper on sand waves in tidal estuaries that the flood-tide tends to follow the chords of the arcs made by the sinuosities of an ebbing current. According to the information collected by the late Mr. Frank Buckland, the Severn in a wet season tends to collect in the Frampton Channel, and in a dry season in the Awre Channel.

That the continued action of the flood-tide upon the sands minimises the bore which it at first produces is further shown by the observation of Mr. D. J. Wintle, of Newnham-on-Severn, who reports to us that "the best heads are two tides previous to the highest tide of the moon—say for four tides before the highest of the moon. The very next tide after the highest tide may run within a few inches of the same flood-mark, but will have a comparatively poor head and lack crispness."

The Report also contained notes on the following subjects :—

On the Size of Waves as related to the Rate of Advance of a Cyclone.

In the last report it was stated that fairly consistent results had been obtained in correlating the height of ocean waves with the velocity of the wind which causes them.

There is, however, no such close relation between the velocity of the wind and the length of the waves.

The greatest waves will be developed in that part of the cyclone in which the direction of the wind coincides with the direction of advance of the cyclone, and I wish to call attention to the fact that, along this line of action, of all the waves which the velocity of the wind is capable of increasing, that length will enjoy superior opportunities for growth *whose group velocity is equal to the rate of advance of the cyclone*, the storm either outrunning or lagging behind the transmission of energy in waves of any other length. The velocity of the group in deep water is half the velocity of the individual waves.

It was pointed out in the last report that the period of the longest recorded swells corresponds to a wave velocity about equal to that of the greatest recorded hourly velocity of wind (the velocity of the dominant wave in storms being much lower).

It may now be added that no records of swells have been met with having periods approaching those appropriate to a deep-sea velocity equal to that attained during the gusts of a storm.

Mathematical investigations have pointed to the tendency of wind finally to produce steep waves of velocity equal, or almost equal, to that of the wind. When, however, we come to compare the observed velocities of wind, the observed dimensions of cyclonic storms, and the lengths of waves of velocity equal, or nearly equal, to that of the strongest winds, we find that we rapidly approach a condition of things when the stretch of water subject at any one time to such wind is only a small multiple of the wave length ; a condition in which steep waves could not be maintained.

On Regular Undulations produced in a Road by the Use of Sledges.

The chief result of the investigation may be summarised thus: When the detritus consolidates readily under pressure, undulations arise spontaneously by the action of a steadily moving sledge when furrowing a homogeneous road. The wedge of detritus travelling in front of the prow of the sledge becomes compacted, the sledge surmounts it (rolling like a wheel), and the detritus remains behind as an excrescence incorporated with the road. At the same time the sledge pitches, furrowing the road more deeply and accumulating detritus in front, which it finally surmounts with the rolling movement which assists to compress and bind the material, building up the next crest.

Wave Phenomena of the Niagara.

I have visited Niagara Falls, N.Y., with a view to reporting upon some of the characters of *the waves of rivers* which I judged would be seen in full development in the rapids below the falls. There has not yet been sufficient time to work up the results of these observations for publication, but they will ultimately form an important part of a comprehensive study of the waves of rivers.

As an indication of the character of the phenomena observed at Niagara it may, however, be stated that in the tremendous current of the Whirlpool Rapids (depth about 50 feet) there is, in addition to the usual stationary waves of rivers, a remarkable development of visible travelling waves, giving rise to many complex and beautiful results and contributing to the formation of the enormous *leaping waves* which are one of the most awful exhibitions of the conflict of waters which the world affords. What is here termed the "leaping wave" is a variety of wave almost as distinctive as the "breaker" or "the swell."

Lieutenant Shackleton then exhibited a series of views illustrating the work of the National Antarctic Expedition, which aroused a great deal of interest and attracted a large audience.

In the afternoon Lieutenant-Colonel C. C. Manifold, of the Indian Medical Service, read a paper on Recent Explorations in China. The paper embraced an account of two journeys to the regions of the Upper Yangtsze, immediately before and after the Boxer outbreak. The first journey, in 1900, lasted for seven months and ranged from Burma to Tibetan territory and across China to Shanghai: and the second, made in 1901-2, lasted for nine months and took him from Peking almost back to the confines of Burma. The distance covered was nearly 6000 miles of land travel on foot and 3000 miles on inland waterways. The starting-point of the first journey was Bhamo, our frontier garrison town on the borders of Burma and China. The road taken was a well-known trade-route to Teng-yueh, the nearest large trading centre in Yun-nan, a town more commonly known by the name of Momein. It had been proposed to connect Bhamo and Teng-yueh by railway, and though it would not be feasible to carry the line any further, even this sort of line would pay its way and increase our trade and influence in Yun-nan. Yun-nan-Fu, the capital of the sparsely populated and at present poor province of Yun-nan, was the half-way house to the rich regions of the Upper Yangtsze. A French company had now obtained a concession for a railway from the frontier in Tong-king to Yun-nan-Fu, and they hoped in time to carry it to the Upper

Yangtsze and so divert the trade to their own port of Hanoi. The construction of the line had already been started.

After meeting with considerable difficulty in crossing the higher passes, the party reached the eastern border of Tibet, and ultimately made its way to Ta-Chen-lu. From Ta-Chen-lu they followed the great tea road between Tibet and China, so called because of the great traffic in tea carried between Lhasa and Ya-chou. Millions of pounds' weight of coarse tea sweepings go into Tibet from Western China, and the lecturer pointed out that if free commercial relations could be established with Tibet there was no doubt that the better and cheaper Indian tea would capture this market. From Ya-chou the route taken was by raft down a tributary of the Yangtsze, then through the Yangtsze gorges to Ichang, and then by steamer, 900 miles, to Shanghai. Proceeding thence to Tientsin the party were just in time to join the Peking relief expedition. On September 20, 1901, Lieutenant-Colonel Manifold with a companion started again on a journey of some thousands of miles across Central to Western China in the opposite direction to that in which he had travelled before. From Peking they travelled 90 miles by the French-Belgian controlled line which was to run to the Yangtsze Valley at Han-kau, a line which was likely to have a great effect on the development and history of China, as it traversed some of the most populous and fertile districts of China. Trains were now running from Peking for 160 miles, and from Han-kau for 200 miles along the southern section, the materials for construction coming from France and Belgium, and the larger bridges having been contracted to Italians. At Han-kau the line was connected with one from Canton now under construction, and by the concession the road materials were under the control of American firms, though most of the shares were said to have passed into the hands of Belgian syndicates. Thus there was not much room here for British enterprise. They marched to Chen-Ting-fu, 50 miles further. There, too, they found evidence of foreign railway enterprise. Many bridges would have to be constructed, the largest across the Yellow River itself at Yung-tse. There it was satisfactory to find evidence of British energy in a railway 700 miles distant from a seaport; but on crossing the Yellow River and reaching the city of Kai-Feng-fu they found evidence of Continental enterprise, especially German. The lecturer then gave a description of the province of Szu-chuan, with its 45,000,000 of inhabitants and immense industries, which from the point of commerce had the most interest for us. A narrative followed of the Red Basin with an area of nearly 80,000 square miles and a population of over 40,000,000, the densest agricultural population in the world. Every foot of soil was under crops, and scarcely a piece of waste land was to be found. Rice, wheat, millet, peas and beans, sugar-cane, and every sort of vegetables were grown in abundance, and in many places were brine wells, 2000 feet deep, salt being a very valuable product in China. In other parts rich iron ore, copper, and quicksilver, and also gold were found in great quantities. At Ichang the Yangtsze emerged from the mountain barriers and became navigable nearly 1000 miles from the ocean for vessels of over 1000 tons. Through

the enterprise of Mr. Archibald Little a trading steamer, the *Pioneer*, was placed on this stretch of the Yangtsze, and there was hope, if we effected an efficient line of communication, of developing the resources of this vast province. Many persons were in favour of leaving foreign nations to run the risk of losing their capital in enterprises in these regions, but it should be remembered that they would set up preferential tariffs and might acquire a permanent protectorate; but when we looked at the enormous traffic in the only British controlled enterprise, the Peking-Tien-tsin-Shan-hai-Khan line of the Imperial Chinese Railways, such an over-cautious policy hardly seemed worthy of us. When it was recognised what railways had done for British India, far more might be expected from China, which had much greater resources and undeveloped wealth. China, too, possessed 400,000,000 of willing customers, whose industry, intelligence, and civilisation gave them a high standard of comfort. It was necessary that the British Government should wake up and recognise the importance of this question.

A paper was then read by Mr. JOSEPH PARRY on "The Afforestation of Waterworks Catchment Areas."

On Monday a joint meeting with Section L. (Educational Science) was held in order to discuss the Teaching of Geography. The discussion was opened by Mr. H. J. MACKINDER, who, in the course of a paper, said that classics and mathematics were effective educational disciplines largely because, as the result of long experience, they could be taught by methods which were progressive from the lower to the higher forms of a school. If geography were to be generally utilised in secondary education it must become similarly progressive rather than merely cumulative of facts. In practice this implied the fulfilment of three conditions:—(1) That the pupils should be classed in special "sets" for geography, lest they omitted stages in the argument; (2) that the master should know the subject thoroughly; and (3) that the public examinations should be based on some generally accepted sequence of exposition, as in the case of languages and mathematics. It would probably be hopeless to expect a general fulfilment of the first two conditions unless the third were practicable. The phenomena of geography were capable of arrangement upon alternative principles, either according to regions or according to categories. In the one case the chapter headings of a text-book would be such as "France," "India," etc.; in the other they would be such as "volcanoes," "climates," etc. The former was spoken of as regional geography, the latter as general, or commonly, but unfortunately, as physical geography. In the University the general classification might often be advisable, but in the school it was submitted that the regional basis should in the main be adhered to, for distribution was of the essence of geography and imparted to regional geography a unity not possessed by physical geography. Indeed, the latter might be described as a series of chapters treating of the geographical aspects of other sciences—astronomy, geology, meteorology, botany, zoology, anthropology, strategy, economics, and history. The separation of school geography into two subjects, topography and

physical geography, had probably done more than anything else to arrest its development as a discipline. It was suggested that it would be quite possible to weave into the regional treatment so much as was needed of other sciences by taking these in one at a time in the successive stages of the strictly geographical argument. This idea would be most easily conveyed by sketching a possible course of instruction. Stage 1 (elementary).—The teaching of geography should commence with the home. This, however, involved among other things the observation of the apparent movements of the sun and stars, and hence their explanation by means of the globe. The lie and names of the continents and oceans would also be learnt upon the globe, and some idea of their chief contrasts won from the reading of simple stories of discovery, adventure, and travel, the teacher everywhere asking the pupil to contrast with the home conditions. Stage 2 (ages 13 and 14).—This should have for subject such a wider "home area" as would permit of the study of entire river-basins, water partings, coast and hill forms, etc. The real study of the use of maps as opposed to mere plans and sketch maps would commence here, and this would be the approximate stage for the introduction of such ideas as the deposition, folding, faulting, and sculpture of rock strata as explanatory of the surface forms. Stage 3 (ages 14 and 15).—Here the "home country," the British Isles, would be considered as a whole. The land-forms and essentials of structure would be quickly yet accurately conveyed by the use of the ideas and terms learnt in Stage 2, and time would thus be available for a thorough explanation of the climatic contrasts, a subject unsuited to Stage 2 by reason of the limitation of the area then studied. Moreover, the teaching of elementary physics by the science master would at about this stage render the fundamental ideas involved more easily appreciable. Stage 4 (ages 15 and 16).—At this stage they came to the comparison of the home country with the great civilised countries of Europe. The physical facts, both morphological and climatic, would be conveyed quickly yet accurately by means of the ideas and terms learnt in Stages 2 and 3, and special stress would now be given to the political and economical facts. The pupils would be ready for these by reason both of their progress in history and of their increasing interests in the newspapers. Care would be taken to correlate the political with the physical. Problems and essays would be set. Stage 5 (ages 16 and 17).—This would be devoted to the study of the whole globe, especially outside Europe. It might include more accurate astronomical ideas, for which the pupils would have become fitted by reason of their mathematical studies, also the leading facts conditioning plant-life. Both of these contributions would be pertinent to the treatment of climates. The history of discovery would be utilised in explaining the chief place-names. The pupils would by this time have accumulated a considerable background of knowledge which would be appealed to. The increasing wealth and variety of the data would necessitate firm grip on principles and a logical method. Therefore a specialist teacher would be advisable in order to obtain mental discipline, just as a classical sixth form required a composition master.

Stage 6 (University and college).—Here they should naturally find both deeper intension and wider extension. By the adoption in part of the general classification—*i.e.* by the study of the distribution of particular types of phenomena—the student would become critical and be prepared for original research. On the other hand, by the complementary effort to construct a harmonious regional geography out of a great series of varied data he would be inspired with a broad and philosophical outlook. Nowhere, said Mr. Mackinder, was the contrast between the general and the regional method more conspicuous than in the treatment of the wind system. The temptation was great to commence deductively from an imaginary landless globe. But this was essentially unsound, because it implanted wrong and unscientific habits of thought. The trade winds, for instance, should first be learnt of and realised as a great fact in the description of the North Atlantic, the complementary wind being added in the description of the South Atlantic. The double system would then be found again in the Pacific, and a generalisation demanded by the pupil which would presently be limited by the facts of the Indian Ocean. The Sahara Desert would carry the generalisation a step further and into apparently different phenomena. Only in the end would deduction from ideal zones or belts of climate be permitted by way of mental stocktaking. Geographical teaching, if it dealt with real conceptions and not merely names, trained in the mind a distinct power, that of thinking in terms of the map, of visualising intricate correlations, of ordering complex masses of fact—a power of the utmost value in the practical affairs of after life. Geography rightly taught should tend to correct the academic bias of linguistic and mathematical study, the specialist bias of scientific study, and the archaic or sentimental bias of historical study. Its danger lay obviously in superficial knowledge and uncritical thought. Taught in the past too often by those who knew little of it, geography had no doubt deserved its inferior position among educational disciplines. Geography could be placed in its rightful position only by the simultaneous application of a fourfold policy:—(1) The encouragement of University schools of geography where geographers should be made, of whom many would become secondary teachers; (2) the appointment of trained geographers as teachers in our secondary schools, either for geography alone or for geography and general help in other subjects; (3) the general acceptance of a progression of method in the subject, not expressed in detailed syllabuses issued by the State or other dominant authority, which would tend to stereotype teaching, but in a tradition similar to that which at different times had governed the teaching of language and mathematics; and (4) the setting of examinations by expert geographical teachers. It was obvious that these four measures must be applied simultaneously, for schools would not appoint specialist teachers unless there was a supply of them to select from, and a supply would not be forthcoming unless there were a promise of posts, nor was the teacher independent of the examiner nor yet of the general esteem of his subject based on a belief in the value of its methods. The adoption of a new syllabus for geography in the London matriculation and of geography as an obliga-

tory subject in the intermediate examination of the faculty of economics and commerce, coupled with the appointment of a holder of the diploma of the Oxford School of Geography as teacher of the subject at University College School, London, had contributed to results which were patent in the Pass List issued last month by the London University.

Mr. Mackinder was followed by Captain Wilson Barker, Mr. Hugh Richardson, Mr. S. G. W. Hewlett, Mr. G. Fletcher, and Mr. C. Brereton.

Mr. Brereton said that geography had been till recently the Cinderella of secondary education. Its right to be considered a distinct subject had often been denied, and it was only by taking history as its chaperone that it had been able to appear in the curriculum at all. Unfortunately, a certain amount of disdain with which the teaching of geography has been treated in the past was due to the purely descriptive nature of the subject, as then understood, which afforded but little scope or exercise for the thinking faculties. The teaching of geography in the schools, a teaching which had largely survived to-day, consisted in setting boys to learn long strings of names of places which they were supposed to be able to locate more or less correctly on the map. Had these lists dealt only with physical or political facts of great magnitude little harm would have been done. However, the general conception of geography, and with it the conception of geographical teaching, had radically changed. The purely mnemonic system was falling into discredit, and the rational method of building up geographical data into a logical science was coming into play. In a word, geography was developing into a mental discipline of the best kind, not only exercising the intelligence, but touching the imagination. The time allotted to the subject in English schools was still extremely limited, consisting, as a rule, only of one or two periods a week. Somewhat ambitious programmes had been formulated which, while excellent as ultimate ideals to aim at, were for the present somewhat beyond our reach. The problem for teachers and inspectors at the present time was to discover the improvements which were possible under existing conditions. A diagnosis of the general state of geographical teaching in the secondary schools indicated that the memorising of mere data still largely held undisputed sway. Physical features were crammed up in lists. Their overwhelming influence on political conditions was ignored. The vital questions of configuration and climate were left untouched by the majority of teachers. If climate was mentioned at all, everything was attributed to the beneficent effect of that *deus ex machina* of childhood, the Gulf Stream. Teachers and pupils alike stared when one asked why the Sahara was a permanent desert. Maps were not properly utilised. Yet a good wall map rightly understood was a window of the school that looked out on the wide world. The art of map-drawing was not properly taught. Pupils were allowed to fill in physical and political features higgledy-piggledy at one and the same time. Teachers, again, relied too much on text-books, many of which were out of date or more or less incorrect. We could improve matters a good deal if we began by making jettison of much of the lumber which encumbered our geographies to-day, by effecting a clean sweep of all unimportant capes,

bays, islands, rivers, and lakes. Those which were left in should not be taught in lists, but woven into a logical and systematic treatment of the country to be studied, with configuration and climate taken as its basis. Pupils should not spend too much time in learning the highest points of mountain ranges, they should study the effect of these ranges on river-basins, on climate, and rainfall. They should note the gaps or passes which had given rise to the creation of towns owing to trade-routes passing through them, or had afforded passage to railways which, it should be demonstrated, always took the line of least resistance. The importance of railways in opening up a new country like the western parts of the United States, or Uganda, should be insisted on. More and better maps were wanted. Inset maps of the British Isles should always be used in studying foreign countries. This was the only way of bringing home to the pupils such facts as that New York State was nearly as big as England, and that Texas was larger than Germany. When teaching history the teacher should always have a map before him. Literature, likewise, should be co-ordinated with geography. Once pupils realised that the scenery in a poem like the *Lady of the Lake* could be set out in a sketch map, they took a far livelier interest in the poem. There were three main difficulties with which the teaching of the subject would have to contend—namely, the lack of adequate preparation in the pupils on their entrance into the secondary schools, the lack of really qualified teachers, and the lack of touch between the examiners and the schools. Until English came by its own, geography would always be at a disadvantage. No doubt the syllabuses of the Royal Geographical Society would do something to bridge the gulf between examiners and teachers, but they scarcely touched the root of the matter. Only constant contact between examiner and examined could prevent too much ground to be covered being set, or unsuitable questions being asked. The remedy seemed to be to appoint revision committees to consider draft syllabuses and papers; committees composed of inspectors engaged in the work, and of teachers interested, but not actually engaged in preparing for the examination, together with a geographical expert to keep the paper up-to-date. In this way teachers would not find themselves, as they often do, between two stools—between inspectors advising them to teach one way and the examination papers tempting them to teach in another.

A discussion then took place in which the proposals brought forward by Mr. Mackinder and the other readers of papers were criticised by Mr. Herbertson, Mr. J. L. Holland, Mr. Scotson, Professor R. A. Gregory, Miss Walter, and Captain Creak.

In section E the first paper read was one by Mr. G. A. Reeves on "Notes and Suggestions on Geographical Surveying suited to present Requirements." The paper pointed out in the first place that the advance of geographical exploration and discovery during recent years has been so rapid that there are now few parts of the earth's surface of which we have no knowledge whatever, although of many regions the best maps we possess are still extremely rough and inaccurate. The time has now come for replacing these approximate route maps of the pioneer

explorers by more accurate surveys based upon scientific principles, without attempting the extreme accuracy of a large trigonometrical survey, for which, in many parts, we must necessarily wait for a long time yet.

It then briefly indicated the best methods of geographical surveying that might be followed, guided to a great extent by the course of instruction in geographical surveying arranged by the Royal Geographical Society.

After preliminary remarks as to the necessity of ascertaining what has already been done in the region to be visited, and as to whether any points have been definitely fixed which could be used as a basis for the survey, the author described the best forms of the more important instruments required—the transit theodolite, plane-table, half chronometer watch, sextant and artificial horizon, barometer, etc. He then deals with the question of the most suitable scale and projection for plane-table work in the field, and in connection with the delineation of physical features on the map calls attention to the necessity of generalising and interpreting the leading characteristics of the physical features of a country, for which some previous training, not only in map-drawing, but also in physical geography and the outlines of geomorphology, is a great assistance. Two methods of surveying are then described in outline, viz. (1) the extension of the triangulation by theodolite angles and the fixing of fresh points from those whose positions have been previously determined, or by latitudes and azimuths, detail being filled in with the plane-table; and (2) that in which no previously fixed points are available, and the surveyor has to determine the latitude and longitude of his stations from astronomical observations. The former should always be adopted where practicable. The most reliable methods, suitable for an ordinary geographical surveyor, by which the latter can be accomplished, are described, first, as regards the fixing of latitude, and then of longitude. In connection with the fixing of longitude it is pointed out that it has been found practically impossible for a traveller to carry a watch or chronometer that can keep its rate sufficiently well for the determining of longitude with the accuracy that is now required, and recommends, where it is impossible to obtain Greenwich time without relying implicitly upon a watch—such as by telegraph or reference to some place of which the exact longitude is known—that differences of longitude only should be attempted, either by latitudes and azimuths or by using the watch for the meridian distance method. As regards the so-called "absolute methods" of obtaining longitude, that by occultations of fixed stars is to be preferred. A few remarks followed on photographic surveying, and the necessity of the surveyor being able to draw his own instead of merely furnishing the draughtsman at home with a rough and to a great extent unintelligible sketch, which is often the case.

After a short paper by Mr. Morrison on the best projections of maps for general geographical purposes, Mr. Edward Heawood read a paper on "Henricus Glareanus (Sixteenth Century Geographer) and his recently discovered Maps."

Mr. Heawood said that Heinrich Loriti, one of the most celebrated

of the "humanists" of the sixteenth century, better known by his territorial designation, Glareanus, was born in 1488, at Mollis, near Glarus, in Switzerland. His title to fame rests principally on his many-sided contributions to knowledge in the field of literature, philology, mathematics, music, etc.; but he is known also as the writer of a work on geography which passed through many editions from 1527 onwards. In this he described, for the first time, so far as is known, a convenient method of constructing gores for a globe, which was much used in his time, though as examples of such gores are known from considerably earlier than 1527, some doubt has been expressed whether he was the actual inventor of the method. Coloured manuscript maps from his hand have within recent years been discovered in copies of printed works at the libraries of Munich and Bonn Universities, and have attracted some attention from the fact that they were, according to their author's statement, based upon the long-lost map of Martin Waldseemüller, which has itself been discovered since. One of the maps was also interesting as the earliest known representation of a hemisphere on an equidistant polar projection.

At the time of the Elizabethan Exhibition, organised by the Royal Geographical Society early in 1903, a volume of early MSS. was sent in which at once attracted attention from the fact that the first item, though without a contemporary statement of the author's name, was stated in a note by a former owner to be by Henricus Glareanus. Further inspection showed that the handwriting was identical with that on the margins of the Bonn maps, and that the MS. was that of the treatise on geography published in 1527, but that it included a fine coloured set of unpublished maps, closely resembling those at Bonn and Munich, but more in number and somewhat more carefully executed. Particularly interesting was the fact that a pair of the maps were evidently copies of the famous map of Johan Ruysch, issued with the Rome *Ptolemy* of 1508, while both the northern and southern hemispheres were shown on an equal scale on the equidistant projection, the southern having been given on a much reduced scale, and with the continental outlines reversed, in the Bonn copy. Examination showed that the MS. was the original MS. of the work (many alterations and marginal additions made on it having been incorporated in the printed edition), but not the copy from which the printer had worked, as further corrections and additions appear in the printed volume. From the great resemblance of the maps to those at Bonn, which were made in 1510, and the fact that Glareanus was in correspondence with the Swiss reformer, Zwingli, on the subject of geographical studies in the same year, it seemed probable that the treatise was first written considerably before 1527, and this idea is supported by the nature of the additions made in the printed work, which include references to the "eruditus rex" Henry VIII. of England (whose reputation for learning would have reached Glareanus at an early date, through the latter's correspondence with Erasmus), and to his residence as professor at Paris, which came to an end in 1521. In this case the existence of gores drawn after his method in about 1515 would be explained, while in various ways the claim of Glareanus to originality

as a geographer would be heightened, his work being *e.g.* prior to the well-known treatise of Apianus, which first appeared in 1524. It may be noted that one of the editions of the smaller Cosmography, generally attributed to Apianus, incorporates bodily one of the chapters of Glareanus's work.

In the afternoon Dr. H. O. FORBES, director of the Liverpool Museums, presented a report of the results of the expedition consisting of Mr. W. O. Grant, of the British Museum, and himself to Sokotra and Abd-el-Kuri. He said that at the meeting of the Association at Bristol in 1898, a committee was appointed to further the expedition then projected for the exploration of these two islands, which were situated in the Gulf of Aden, and a sum of money was placed at their disposal. The councils of the Royal Society and the Royal Geographical Society also generously assisted the expedition by grants of money and instruments, while the Museums Committee of the Liverpool Corporation gave substantial aid in money and also by allowing the chief taxidermist of the museum to accompany the expedition. The Museums Committee, in addition, undertook the publication of the results. The expedition left England in October 1898, and returned in March 1899. A preliminary report was presented to the Association at Dover, and he now laid on the table the recently completed account of the results of the expedition. The objects of the expedition were biological, mainly, and geographical. The volume of results was practically a zoological monograph of the islands. A large number of plane-table and theodolite observations were made, and also many anthropological data collected. A large scale map was in process of construction from the plane-table sheets, but they and the instruments that were being used in the work were purloined from Dr. Forbes's house during repairs by a workman. Every effort was being made to recover them, but in the meantime it was impossible to proceed with the construction of the map. No new mammals were obtained by the expedition, but specimens of the interesting wild ass, which proved to be the Nubian and not the Somaliland species, were obtained. The domestic cattle, a beautiful diminutive breed, seemed to be here a long isolated colony of the *Bos longifrons*, introduced probably from Egypt before the Christian era. Of birds sixty-eight species were known in Sokotra, of which ten species were added by the expedition. From Abd-el-Kuri they recorded twenty-two species, three of them new to science. Of mollusca sixteen new species were enumerated; of spiders and scorpions there were eighteen new species, and six species of crustacea from Abd-el-Kuri were reckoned new. Among insects a large number had proved to be new endemic species. The examination of the botanical specimens by Professor Balfour showed four species to be new to science, and six otherwise known to be new to the flora. The whole of the plants from Abd-el-Kuri, seventy-eight in number, were recorded here for the first time, and of these three were new to science.

Subsequently Mr. J. LOMAS read a paper on "The Origin of Adam's Bridge."

Considerable disappointment was felt at the absence of Major Scott-

Harden, who was expected to read a paper entitled, "Across Somaliland with the Field Force," but was unable to be present.

On Tuesday morning all the papers read dealt with botanical subjects. The first paper was by Mr. Otto Darbishire, "On the Relation and Importance of Botany to Geographical Science."

Mr. DARBISHIRE said, that plants play a very important part in the composition of the scenery of our earth. So much is this the case that a barren desert strikes us as remarkable, chiefly on account of the absence of any vegetation.

The professional geographer and traveller has generally at most only a very slight acquaintance with any branch of botany. The problem before us is, Would an acquaintance with certain branches of botany be of any scientific interest or practical value to the geographer?

Botany and geography meet on common ground in the following branches of botany:—

(*a*) The geographical distribution of plant species. The distribution of plants when grouped according to their natural affinities into natural orders, genera, or species is seen to depend very generally on the distribution of temperature over the earth's surface, without reference as a rule to local conditions.

(*b*) The geographical distribution of plant forms, or ecology. The plant form is an expression of the way in which the plant body has adapted itself directly to the external conditions under which the plant is living. It affords, therefore, to a certain extent, an indication of what these conditions are. An association of similar plant forms is called a formation. The presence of any of the three chief kinds of formation, namely, forest land, grass land, and desert land, depends almost entirely on the relation existing between the supply of water available for absorption by the plant root and the amount of water given off by the plant shoot. The preponderating influence may be due to the climate (climatic formation) or the soil (adaptive formation). Temperature generally has no hand in the making of the plant form.

(*c*) The influence of the plant world on the earth's surface. Most sub-aërial plants penetrate into the soil for purposes of attachment or absorption of food material. Their action may be a physical one only, or a chemical one in addition. Plants are as often responsible for the first crumbling away of the solid rock as for the binding together of loose soil.

These three subjects are of great interest to the geographer, but ecology is in addition of the greatest importance to the traveller.

Ecology teaches the traveller how to analyse and classify the forms of vegetation met with. He is enabled through it to make out many of the prevailing conditions by reference to the plant forms observed. He is also enabled to give a scientifically accurate account of what he has seen, because he understands the relation existing between the plants and the conditions under which they are living. A knowledge of ecology should, in fact, be considered a most necessary part of the scientific equipment of any professional traveller.

Dr. W. G. SMITH then spoke of "The Observation of Vegetation in

Geographical Exploration," pointing out the need for more detailed observation on the part of explorers of the main features of the vegetation of new countries, and explaining the methods of recording the observations on maps and charts illustrating by the maps now being published of British areas.

Dr. Smith was followed by Mr. LEWIS, who gave an account of the "Botanic Survey of the Rivers Eden, Tees, Tyne, and Wear."

The survey was begun during the summer of 1900, and has for its object the mapping of the various plant associations and observations on the different factors governing their distribution.

The whole of the work has been done with the aid of the 6-inch Ordnance maps, the boundaries of the different associations as observed in the field being drawn on these, and subsequently reduced on to smaller scale maps.

The salient features of the vegetation may be summarised as follows:—

The region of cultivation is very restricted, and chiefly confined to altitudes below 1000 feet, and the greater part of it is under permanent pasture, although cultivation with oats is carried on below 800 feet.

The region of woodland is poorly represented, and may be divided into (1) oak woods, (2) coniferous woods, (3) birch woods. The oak woods only occur below 800 feet, and coniferous and birch woods only reach in a few instances an elevation of 1000 feet.

An examination of the peat on the higher fells shows that the ground has not always been of its present treeless nature. Remains of birch, alder, and poplar may frequently be discovered buried about 16 or 18 feet down in the peat, and the author has observed extensive remains of birch as high as 2400 feet, being higher than it grows anywhere in Great Britain at the present time. Remains of pine also occur as high as 2600 feet on Cross Fell. Sections are being made through the peat in areas now covered by heather moors, *Eriophorum* bogs and *Sphagnum* bogs, and sufficient evidence has been collected from these sections to show that nearly the whole of the high-lying watersheds of the Tees, Tyne, and Wear have at some former time been covered with extensive woods of birch and pine.

Pasture associations are chiefly represented by grass heaths dominated by either *Nardus stricta* or *Molinia varia*, according as they occur in well-drained or wet situations. The natural pasture is limited to outcrops of limestone free from peat, and is generally met with in narrow bands or patches, sometimes occurring in the midst of extensive grass heaths or heather areas. The heather associations reach their greatest development in the Middle Fell district on limestone covered with peat. The Stainmore district, to the south of this, consists of sandstones, grits, and shales, and the chief associations here are *Eriophorum* bogs and *Sphagnum* bogs. These associations also attain a great development on the sandstones and shales of the Wear watershed.

The chief artificial agency at work tending to modify the vegetation in some places appears to be overstocking with sheep, the constant browsing, treading, and manuring tending to kill the natural heather vegeta-

tion. Under these circumstances the heather area in a badly drained situation may be changed into an *Eriophorum* bog, and in a dry, well-drained position into a poor grass heath chiefly dominated by *Nardus stricta* and *Juncus squarrosus*.

A detailed account of this survey, with maps, will be published in the *Geographical Journal*, and the author hopes to extend the area of observation northward to the Cheviots and westward to the coast covering the northern portion of the Lake District.

Mr. Moss then read a paper on the "Age and Origin of the Peat Moors of the Southern Pennines," in which he classified the moors into (1) cotton-grass moors, (2) heather moors, (3) grassy moors. On a variety of grounds it is believed that the summits of the Pennines were tree-clad so late probably as the Roman period, and that the destruction of these forests led to the formation of an extensive morass on the summits, though the slopes were still tree-clad in Saxon and Danish times. As a rule, therefore, the peat moors of the Pennines cannot be regarded as more than about two thousand years old.

In the afternoon a paper on Queensland, by Mr. J. P. Thomson, was read, and the usual votes of thanks brought the proceedings of the section to a close.

The next meeting of the Association is to be held at Cambridge under the presidency of the Right Hon. A. J. Balfour, and opens on August 17, 1904.

REPORT OF THE PROGRESS OF THE ORDNANCE SURVEY.

The Ordnance Survey Report to the end of March 1903 has been recently issued, and we summarise here some of the more important of its contents, especially those relating to Scotland.

As regards the cadastral survey on the 1 : 2500 scale, the survey and publication of the maps of the cultivated portions of Scotland were completed in 1882, with the exception of the counties of Wigton, Kirkcudbright, Edinburgh, Haddington, Fife, Kinross, and of the island of Lewis. The plans on this scale of the cultivated portions of those six counties, and of Lewis, have now been completed and published. The total area of Scotland published on this scale is 15,107 square miles. The revision of these maps was begun in 1894. Since that year the revision on the ground of the maps of the following counties has been completed :—Aberdeen, Ayr, Argyll, Berwick, Bute, Clackmannan, Dumbarton, Dumfries, Forfar, Kincardine, Lanark, Linlithgow, Orkney, Peebles, Perth, Renfrew, Roxburgh, Selkirk, Shetland, Stirling. The revision on the ground of the following counties is in progress :—Banff, Elgin, Inverness, Ross and Cromarty. Publication of the revised maps is proceeding as rapidly as possible after the completion of the manuscript maps. The total area of the revised maps published is 9104 square miles, of which 894 square miles have been published during the year.

Maps on the Scale of Six Inches to a Mile.—The whole of

the maps of Scotland on the six-inch scale were published by 1882. A second edition of the six-inch maps of Wigton, Kirkcudbright, Edinburgh, Haddington, Fife and Kinross, and the island of Lewis has since been prepared, based on the 1 : 2500 re-survey of these counties, except in the case of the uncultivated districts, which were revised direct on the original six-inch maps. The publication of the second edition for these six counties includes an area of 2713 miles. The six-inch maps of the revised counties of Scotland are, for the cultivated districts, being reduced from the revised maps on the 1 : 2500 scale, and are published by heliozincography, except in the south and west of Inverness-shire and in Deeside, where the alterations have generally been so small that the revision is being carried out direct on the copper plates. In uncultivated districts the revision is made direct on the original 6-inch maps. Publication follows as soon as possible that of the 25-inch maps. The total revised area published on this scale is 14,758 square miles, of which 1808 square miles have been published during the year.

Maps on the Scale of One Inch to the Mile.—The 1-inch map in outline of Scotland was completed in 1887, and the map with hills in 1894. The publication of the revised 1-inch outline map has been completed. As in the case of the English maps, various changes have been introduced with a view to adding to the value of the map for military purposes, and for the use of travellers, without diminishing its value for civil purposes. One of the most important of these changes is the classification of roads into four classes, of which the first two only are fit for fast-wheeled traffic. In two details only do the Scottish maps differ from the English ones. In the first place, the symbol showing contour-lines in Scotland has not been altered, as in England and Wales, from a dotted line to a chain line. In the case of Scotland the maps are generally more open and less crowded with detail than in the case of England, and the dotted lines of the contours are therefore more easily followed. In England the dotted lines were very difficult to follow, and they have therefore been converted to chain lines. To make this change in the mountainous districts of Scotland was not only unnecessary, but the change would have made the maps much heavier in appearance. The other difference is that on the maps of Scotland the names of the parishes remain written as formerly in capital letters, distributed over the area of the parish, whereas in the case of England the names are printed, in type of ordinary space, on a limited area of the parish. In Scotland there is very often no village of the same name as the parish, and unless they were thus written, the parish names would often not appear on the maps at all. With these two exceptions, all symbols and details shown on the revised 1-inch maps of Scotland are similar to those shown on the English 1-inch maps; and these maps are practically uniform for the whole of Great Britain.

In Scotland the hill features were engraved on the same plate as the outline, although there is also a separate outline plate. It is only on these separate plates that the recent revision has been carried out. To carry it out on the hill plates in addition would not only have doubled

the cost of engraving the revision, but would have entailed damaging and repairing the hill features on the plates. On the other hand, if these hill maps are to be published unrevised, they will gradually go out of use, the original cost of drawing and engraving the hills will be thrown away, and there will be probably complaints from the public. In order to get over this difficulty, until separate hill plates can be prepared, transfers from the hill plates have been taken, and have been laid down on zinc, after removing all the detail except the hills. Transfers have been also taken from the revised outline plates, and laid down on other zinc plates. From these two sources, a map containing both the hill features and the results of the revision has been obtained by double printing, the outline being in black and the hills in brown. The printing of the hills in brown, while showing the features of the country, enables the names and outline of the map to be clearly read. Publication of the revised hill sheets of Scotland in the manner above described has been completed, and the preparation of separate hill plates has been commenced.

The field revision of the second revision of the 1-inch map has been commenced, and will be carried on at such a rate as to complete the revision of the whole country in fifteen years; 3374 square miles have been revised and drawn during 1902-3, and 655 square miles have been engraved.

Combined 1-inch maps have been published of Aberdeen, Dundee, Edinburgh, and Glasgow.

One-Inch Sheets as Parish Indexes with the Civil Parishes Coloured.—In Scotland as in England the 1-inch scale map is being used for the preparation of parish indexes to the 25-inch and 5-inch maps.

Maps on the Scale of Four Miles to One Inch.—The publication of the outline map of Scotland on the scale of four miles to the inch has been completed. It is published in 17 sheets. This map is engraved on copper, and coast and inland water are indicated by blue colour. It is considered that this shows up the water features better than water-lining. Maps on this scale of counties or groups of counties are being published. A coloured edition of this map with hills in brown, similar to that of England, is in course of preparation, and 26,589 square miles have been published. Publication is proceeding from north to south.

Map of Great Britain on the Scale of Ten Miles to an Inch.—The outline drawing and engraving of this map have been completed. It is in 12 sheets, of which 8 sheets or 45,187 square miles have been completed, and etching is in progress.

Map of the United Kingdom on the Scale of 1 : 1,000,000.—The drawing of this map could not be undertaken until that of the 4-mile map of the United Kingdom was finished. Its drawing has now been completed, and engraving will be started shortly.

Town Surveys.—The plans of all towns entitled to a large survey when Scotland was surveyed have been published. The survey of Glasgow has been revised and extended, and the publication of the new plans on the 1 : 500 scale was completed in 1895.

The re-survey and revision of Aberdeen and Dundee on the 1 : 500

scale have been completed, and published at the expense of the Corporations.

As regards the Publication Department at Southampton, the work has been about normal generally, but in the Photographic Department the work has been very heavy in consequence of the more general adoption of a photographic method of preparing documents for revision, of the introduction of the Vandyke process, and of the more extended use of photo-etching. The work of the Printing Department has also been very heavy, owing to the increased demand for colour-printed maps, and to the large amount of work involved in printing maps for other Departments, especially those for the Census Report. The printing of the latter has been so heavy that the normal work of the Survey has fallen somewhat behind. It was found necessary towards the end of the year to purchase an additional power printing machine, and every effort is being used to work off the arrears of printing. The increased amount of printing is due rather to the demand for colour-printed maps than to any very large increase in the number of impressions required.

Considerable progress has been made with the coloured edition of the 1-inch map, the 4-mile outline maps of Scotland and Ireland with water in blue, the 4-mile coloured map of Great Britain, and the 10-mile outline map of Great Britain with water in blue. These, as well as the Geological 1-inch map, and many of the maps for other Departments, are coloured maps.

The transfer to the Ordnance Survey of the colouring of the geological maps has entailed a great deal of additional work on this Department. The contractors have not been able to keep pace with the demand for coloured maps, and there were large arrears of colouring. As was anticipated in the Report of last year, a sufficient stock has now been coloured to meet present demands.

As regards place-names, the Gaelic names in Scotland are being examined during the revision of the Highland districts. The names are at first locally inquired into by a Gaelic-speaking employé of the Survey, who submits them to the best local expert he can find, and all those which are doubtful are submitted to the "Place-names of the Royal Scottish Geographical Society," which continues to render valuable assistance to the Survey in this matter.

With regard to the somewhat vexed question of the best means of making the maps readily obtained by the general public, the report contains the following details. Messrs. Menzies and Co. have been appointed agents for Edinburgh and Glasgow, with a stock at Edinburgh of the maps of Scotland on all scales. They have also a small stock of maps at Glasgow. Agents have also been appointed in the following towns—Aberdeen, Ayr, Dumfries, Dundee, Falkirk, Galashiels, Glasgow, Hawick, Inverness, Kilmarnock, Kirkwall, Orkney, Oban, Paisley, Perth.

The rate of discount allowed to all agents is 25 per cent. for the larger scale maps and 33⅓ per cent. for the 1-inch and smaller scales, the increased discount for small scales having been sanctioned by the Treasury in 1899. The agents in the country are allowed a small credit

stock of maps of the district in which their place of business is situated, on the condition that when any of these maps are sold from stock they are to be replaced by purchase from Southampton. They receive the maps free of all charges for packing and carriage, unless they require them to be sent specially by exceptional means, or unless the order is for maps of less value than 5s. They receive free all catalogues and pamphlets issued from Southampton, as well as all the index maps, publication lists, etc., which enable them to know when new maps are brought out in their districts and how to order them. When maps become obsolete, the agents return them to Southampton, and are provided, free of charge, with the corresponding new revised maps. If customers order wrong maps, the agent is allowed to exchange them, provided they are sent back at once in good condition, and that new maps of equal value are taken in their place. The agents are allowed quarterly accounts.

Most of the above conditions were introduced in accordance with the recommendations of the Departmental Committee of 1896.

Booksellers who are not agents are allowed to obtain maps at the same discount as the agents, on condition that they prepay the cost of the maps and defray the cost of carriage, except in cases of large orders. Their sales have been about one-seventh of those of the agents. Any member of the public, provided he does not reside in a town at which an agent for the sale of maps has been appointed, can obtain maps direct from Southampton by prepayment of their price and of the postage.

The Postmaster-General in March 1897 authorised the postmasters in about 500 head offices in England, and about 250 in Scotland and Ireland (those places where agents have been appointed being excluded) to transmit orders for maps direct to Southampton and Dublin. Explanatory pamphlets about the maps, and index to the maps of the district in which the post-office is situated, were accordingly issued to all the postmasters concerned. The method of procedure is, that an applicant fills up in the post-office a form with the particulars of the map which he requires and with his address; he pays to the postmaster the full cost of the map, including commission and postage; the postmaster then sends the form and a money-order for the amount paid, less the post-office charge, to the Ordnance Survey Office at Southampton or Dublin, from which the map is sent direct to the address given on the form by the purchaser. The sales carried out in this way have hitherto been small, and until recently diminishing. In July 1901, however, framed specimens were sent to all head post-offices in Great Britain, except those in towns at which there is an Ordnance Survey agent, and the Treasury sanctioned a reduction in the charges for postage and packing. Since this has been done the sales, though still small, show a marked improvement, those for 1902-3 amounting to £242 against a total of £192 for 1901-2 and £88 for 1900-1. In many districts no use is made of the facilities provided by the post-office. There were no fewer than 248 head offices in Great Britain through whom no orders were received. Somewhat similar specimens to those above mentioned are now exhibited by permission of the Postmaster-General at post-offices

in towns where there are agents. The agent's address is printed on them. There is little doubt that as a rule the public likes to see a map before buying it. It is of course out of the question that post-offices should keep a stock of ordinary maps, but it is thought that they might without inconvenience keep a small stock of those issued in book form. The Postmaster-General has allowed this to be tried experimentally at a small number of post-offices with a view to this system being extended if found successful. It is too early to report on the success of this trial. The somewhat small success attained by the introduction of sales through the post-office is in no way due to want of co-operation on the part of the postal authorities; on the contrary, they have given the most cordial assistance in the matter, and the Ordnance Survey Department is much indebted to them for the courteous consideration they have given to any proposals made for improving the sale, and for the help they have so kindly rendered. The sales through the smaller provincial agents have in some cases been disappointing. There were in 1902-3 30 agents in the United Kingdom who sold maps to the value of £10 during the year. In some of the small towns, however, the agents' sales have been satisfactory. On the whole, no serious difficulty has hitherto arisen in carrying out the new system of map sales, the general result of which may be considered satisfactory, and as the public become better acquainted with the increased facilities offered for obtaining the maps, it may be hoped that more advantage will be taken of those facilities. Geological Survey maps can be obtained in the same way as Ordnance Survey maps.

THE EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS.

As was briefly noted in our March issue (p. 155), this Congress will meet at Washington in 1904. The details of the meeting are in the hands of a Committee of Arrangements, made up of representatives from the following ten Geographic Societies, who have united to welcome the Congress and its friends :—

The National Geographic Society—Representative: W. J. M'Gee, *Chairman.*

The Geographical Society of Philadelphia—Representative: Henry C. Bryant.

The Geographic Society of Chicago—Representative: Zonia Baber.

The Geographical Society of California—Representative: Frederick W. D'Zvelyn.

The Sierra Club—Representative: John Muir.

The American Geographical Society—

The Geographic Society of Baltimore—Representative: George B. Shattuck.

The Geographical Society of the Pacific—Representative: George Davidson.

The Appalachian Mountain Club—Representative: A. Lawrence Rotch.
The Mazamas—Representative: Rodney L. Glisan.

Dr. J. H. M'Cormick is acting as Secretary, and there is in addition a Finance Committee, made up of Charles J. Bell, President of the American Security and Trust Company, David I. Day, of the United States Geological Survey, and John Joy Edison, President of the Washington Loan and Trust Company. The Societies mentioned above, through their representatives, cordially invite geographers and promoters of geography throughout the world, especially members of geographic societies and cognate scientific institutions, to assemble in September 1904 for the first international meeting of geographers on the Western Hemisphere.

The first meeting of the Congress will be held on Thursday, September 8, and daily sessions will be held on the 9th, 10th, 12th, 13th, and 14th. According to the Preliminary Announcement, it is planned that the members, associates, and guests of the Congress will be entertained on the 15th by the Geographical Society of Baltimore, on the 16th by the Geographical Society of Philadelphia, and on the 17th by the American Geographical Society in its recently completed home in New York. On the 18th they will have the opportunity of visiting Niagara Falls (*en route* westward by special train), and on the 19th they will be entertained by the Geographic Society of Chicago; while on Tuesday, September 20, they will participate in the International Congress of Arts and Sciences connected with the Louisiana Purchase Exposition in St. Louis. It is also planned to have a geographic exhibit at St. Louis. If any considerable number of members so desire, a general excursion will be arranged from St. Louis *viâ* Laredo and the Mexican National Railway to the city of Mexico, thence *viâ* the Mexican Central Railway and El Pasco to Santa Fé, thence to the Grand Cañon of the Colorado, and on to San Francisco and the Golden Gate, where the Western Geographic Societies will extend special hospitality; afterwards returning by way of Mt. Shasta, Portland, and Mt. Tacoma, and through the Northern Rocky Mountains and the interior plains to the eastern ports.

It is expected that on the excursion from Washington to St. Louis *viâ* Baltimore, Philadelphia, New York, Niagara Falls, and Chicago, the foreign members and associates will be the guests of the societies uniting in the invitation; and that on the general excursion special rates will be secured, reducing the aggregate cost of transportation, with sleeping-car accommodation and meals, from 25 per cent. to 40 per cent. below the customary rates.

The subjects for treatment and discussion at the Congress may be classified as follows:—

1. Physical Geography, including Geomorphology, Meteorology, Hydrology, etc.
2. Mathematical Geography, including Geodesy and Geophysics.

3. Biogeography, including Botany and Zoology in their Geographic aspects.
4. Anthropogeography, including Ethnology.
5. Descriptive Geography, including Explorations and Surveys.
6. Geographic Technology, including Cartography, Bibliography, Orthography of Place-names, etc.
7. Commercial and Industrial Geography.
8. History of Geography.
9. Geographic Education.

Members of the Congress will be entitled to participate in all sessions and excursions, and to attend all social meetings in honour of the Congress; they will also (whether present or not) receive the publications of the Congress. Membership may be acquired by payment of 5 dollars, 25 francs, one pound, or 20 marks to the Committee of Arrangements. Ladies accompanying members may be registered as associates on payment of 2½ dollars, 12½ francs, 10 shillings, or 10 marks. They enjoy all the rights of members, except the right of receiving the publications and of voting.

It is hoped that the Congress of 1904 may be an assemblage of geographic and cognate institutions, as well as of individual geographers; and in order to establish closer relations with the Old World, Spanish will be recognised as one of the languages of the Congress, in addition to French, German, English, and Italian.

Members and delegates desirous of presenting communications before the Congress, or wishing to propose subjects for discussion, are requested to signify their wishes at the earliest practicable date, in order that the titles or subjects may be incorporated in a preliminary programme to be issued in July 1904. The time required for presenting communications should be stated, otherwise twenty minutes will be allotted. It is anticipated that not more than twenty minutes can be allotted for any communication, unless the presidency decide to extend the time by reason of the general interest or importance of the subject. The Presidency, with the complete organisation of the Congress (including delegates), will be announced in the Preliminary Programme of July 1904.

All titles, abstracts, or manuscripts of papers designed for presentation before the Congress, and all proposals and applications affecting the Congress, will be submitted to a Scientific Committee, who shall decide whether the same are appropriate for insertion in the programme, though the decisions of the Committee shall be subject to revision by the Presidency after the Congress convenes.

Members of the Scottish Geographical Society who desire to become members of the Congress, or who are interested in its work, are requested to communicate in the first instance with Colonel Bailey, the Secretary of the Society, as early as possible.

GEOGRAPHICAL NOTES.

EUROPE.

Proposed Railway up Mont Blanc.—According to the *Times* plans have been drawn up for an electric railway up Mont Blanc; and it is stated that the scheme is quite feasible, despite the apparent enormous difficulties. Although the depth of the Mer de Glace and of the Glacier des Bossons where they descend into the valley is considerable, it is believed that in the higher parts of the range it is very much shallower. There are, moreover, various points where the underlying rock comes through the crust of ice, and these would be chosen as sites for the stations, where travellers would get an opportunity of enjoying the view, in the intervals of the tunnel. The tunnel would not be more than seven miles long, and the journey would not be any more unpleasant than those through the St. Gothard or the Mont Cenis.

The line would start at Les Houches, the village at the top of the gorge of the Arve, and at the entrance to the Chamonix valley, and would follow the direction of the existing path to the Pavilion of the Bellevue. This part of the journey would be effected by an open-air funicular railway, of the same type as those at Glion and Mürren. Near the top of the ridge the line would enter a tunnel, and would then follow the trend of the *arête* past the Tête Rousse to the Aiguille du Goûter. The first station would be at Gros-Béchar, and the second at the Aiguille du Goûter, where there is a chalet, in which the seven Genevan students who were missing for several days early in July of this year took refuge from a severe thunderstorm. Up to this point there would be little risk of mountain-sickness for ordinary travellers, but for those with weak hearts it would not be advisable to proceed further.

The next stopping-place would be the Dome du Goûter, where a magnificent view of the Aiguille du Midi, the Mont Maudit, and of the summit of Mont Blanc itself would be obtained. Another station would be at the saddle of the Bosses du Dromadaire, not far from the Vallot Refuge and Observatory. Beyond this the line would have to pierce more than 200 feet below the surface in order to reach the Petits Rochers Rouges. The remaining 300 yards would probably be covered on foot by the majority of travellers; but in order to make the line complete it is proposed to make a small funicular from the Petits Rochers Rouges to the Janssen Observatory on the actual summit. The line would be a rack-and-pinion one (called in French a *crémaillère*), and the motive power would be electricity generated by dynamos worked by turbines fed by the water-power of the River Arve, which already supplies the current for the Le Fayet-Chamonix Railway.

It is estimated that the cost of a ticket to the top of Mont Blanc by this railway would be about £4, which is cheap compared with the £10 or £12 that has to be expended at present on guides, porters, and the expenses of a night at the hut on the Grands Mulets.

ASIA.

The Natives of Chota Nagpore.—In connection with the review of Mr. F. B. Bradley Birt's *Chota Nagpore* which we publish this month, it is of interest to note an article by Mr. J. F. Hewitt on the people of this province in *Nature* for August 20, in which he points out their interest to the ethnologist. Mr. Hewitt says: "The history of the country told in the legends, ritual, and

customs of its numerous tribes, takes us back through layer after layer of deposit beneath the surface of to-day to the first age of Indian village life surviving in Jushpore and Sirgoojya among the Korwas, who are nomad agriculturists living in rude huts of tree branches in forest encampments, vacated every two or three years. The women add to the tribal food they collect in the woods and the animals killed by the men of the tribe, the produce of the crops they sow in their clearing until the soil is exhausted. Their successors were the Mundas and Marya or tree (marom) Gonds, living in permanent villages under the shade of the Sarna or village grove of old forest trees left standing in the ring of cleared rice land, the Gond tribal sacred snake. Beside the Sarna is the Akhra or dancing-ground, where the seasonal dances are held, a separate step and figure being set apart for each season, and thither in the primitive age the women of each village invited to these dances the men of one adjoining it in the same province or Parka, and there the children of each village were begotten as the offspring of the mother trees of the sacred grove. Their Spartan education, in separate establishments for each sex, by the women and men of each village to whom their mothers were sisters, still exists among the Ooraons of Chota (or Chutia Nagpore, as Mr. Hewitt prefers to call it), the Nagas of Assam, the islanders of Melanesia in the Indian Archipelago, and other races. They were taught to repeat the national educational and historical stories, and made thorough proficients in all their tribal duties."

"We can trace in Chutia Nagpore the stages of advance from the simple primitive villages of the Mundas and Marvas to the elaborate Ooraon villages with allotments for village servants, in which the lands are divided into Manjhus or Lord's land, the Bhuinhiari land of privileged tenants eligible as Headmen, Pahn or Village Priest, and Mahto or Accountant and the land of ordinary tenants, whose duty it is to till the landlord's Manjhus land. We can further study local history in the ritual customs and traditions of the laughter-loving and indomitably independent Mundas and Ho Kols, the Irish of India, of the silent and dogged Bhuyas, the musical Ooraons, forming a mixture of these two types, in the farming skill of the Kaurs and the feudal customs of the Chiroos and Kharwars, the ancestral rulers of Magadha, who attached Chutia Nagpore to their confederacy and ended the chain of aboriginal rulers, in which Mundas, Bhuyas, Gonds, Ooraons, and Kaurs were the successive links."

"The three last, Ooraons, Kaurs, and Chiroo Kharwars, were the sons of the barley as their predecessors were sons of the rice. Their national birthday is the July-August festival of the Kurum, when they dance round the national mother, the kurum almond-tree (*Nauclea parvifolia*), wearing barley shoots in their hair, and the festival corresponds to the Hindu Nag Punchami, the five mother snakes held in the same month. The union of the rice-eating sons of the south with the northern eaters of barley is marked by the Magh festivals of January-February in Chutia Nagpore, and the Magh festival of Puryag at the junction of the Jumna and Ganges, where the union with the men of the south of the Kushika Gonds, who came down the Jumna, is celebrated by the offering as sacrifices of living victims brought in by the northern people as additions to the southern ritual, in which the only sacrifices had been the first fruits of the soil offered by the primitive villages, and the fowls slain by the Munda sun worshippers."

"It was the castes which form the northern stratum of the community who began the custom of wedding brides and bridegrooms to makua and mango trees, while almost all castes still retain the leafy marriage bower in which weddings are celebrated as a reminiscence of their ancestors, who were sons of the

tree before the northern growers of oil-seeds, barley, and other crops of Asia Minor substituted individual marriages for village unions."

The last stage in primitive national history, Mr. Hewitt points out, is that of the race of the trading Jains of the Bronze Age, who made vast excavations in the copper hills of Lando in Seraikela and Baragunda, under the sacred mountain of Parisnath ("Lord of Traders").

AFRICA.

Exploration in the French Congo.—In a recent number of the *Annales de Géographie*, a concise summary is given of recent exploration work in the French Congo and the neighbouring regions. As regards the Congo littoral, the Campo has been shown to be the same as the Temboni of Fourneau, and the Ntem of Crampel, and to be a stream of considerable importance. The last 50 kilometres of its course have been surveyed, and it is found that as far as Yenghe it is barred by falls and rapids, and then passes into an area of marshes and swamps. On the German side it has been shown that the Djah does not, as has been supposed, discharge its waters into the Aina-Ivindo, but takes a wide sweep to the east in order to join the Ngoko. The whole of the south-eastern angle of the Kamerun proves to be a vast, well-peopled forest. The general aspect of the country in the vicinity of these rivers is that of a plateau of 800 metres in height, from which rise a few isolated peaks. The streams run in depressions of varying form and width excavated in the plateau.

Another area which has recently been the object of investigation is the region between the courses of the Sanga and the Ubangi, where the French Congo is, as it were, compressed by the Congo Free State and the German Kamerun. In 1901 MM. Fredon and Cadenat, setting out from Bania on the Sanga, succeeded in reaching the Ubangi by means of the Bali, a stream which runs through a chaos of granite rocks, and forms the headwaters of the Lobai, an affluent of the Ubangi. In 1902 the region of the Upper Likuala was the object of several journeys, and a party succeeded in passing Botungo, and reaching Ebele in a small steamboat, that is in attaining about 1° 10'. The shores of the stream proved to be occupied by villages rich in ivory, and among the forest trees were rubber plants. From the force and depth of the stream at the highest point reached, it would appear that the Likuala extends much further up. At the rainy season all the forest region is inundated, and the country becomes one vast marsh, intersected by canals which render it almost impenetrable. Owing to the absence of land capable of cultivation, much of the country is almost a desert, save at the margin of the streams. On the whole, then, this tract must be regarded as an almost impenetrable forest area, which separates the French Congo into two parts, connected only by the two navigable rivers, the Sanga and the Ubangi.

M. August Chevalier is now exploring the vast tract of country, which has for its centre, to the east of the Shari and the south of Wadai, the countries of Dar Runga and Dar Banda. M. Chevalier limits the name of Dar Banda to the restricted region where the little sultanate of Snussi has been established under French protection, which corresponds to the basins of the Bangoran, the Ba-Mingi, and the left affluents of the Bakare. On his way to Ndellé, M. Chevalier crossed the region of Kagas Balidja. The country consists of a plateau of grits and iron-bearing conglomerates, dominated by the curious masses of grit and granite called Kagas by the Bandas, which have served as natural fortresses against the slave-making Arabs. The region is badly watered and a desert from Kaga Mbra, near the Kukuru, to Ndellé, except near Kagas Balidja and Batolo. On the Ba-Mingi

and the Bangoran, the forest gives place to a border of trees and bushes which recall in appearance the fringe of vegetation at the margin of the rivers of Europe. It is possible that here flocks and herds might thrive. Continuing his journeys from Ndellé, M. Chevalier has found the sources of most of the rivers which form the Ba-Mingi and the eastern network of the Shari. About 80 kilometres to the south-east of Ndellé he saw the point where the three great basins of Central Africa, those of the Shari, Congo, and Nile, converge together. The great plateau which forms the limit of these river basins is studded with caves, formerly occupied by the Bandas, who endeavoured there to escape from the slave-making Arabs. But these caves are now all deserted, their former inhabitants having been massacred or enslaved, or else have fled the country.

A later communication in *La Géographie* gives some further details in regard to M. Chevalier's explorations. The most interesting point in regard to these is the investigation of the lake and plain of Mamun. Mamun is at the dry season a low-lying marshy plain, traversed by five great rivers, the Tété, the Mussuburta, the Bungul, the Mindja or Djahap, and the Bahap, which are connected together by numerous branches. To the east of Dar Sara and Dar Salamat, these five streams unite to form a river which was called the Auk by Nachtigal. Of this river the Bungul is the most important tributary. In the dry season in the vicinity of the Bahap there is a shallow (0·50 m. to 1 m. in depth) stretch of water, 40-50 metres wide and 4 kilometres long, which constitutes Mamun in the narrow sense. At the rainy season this area is the centre of a vast lake, filled with aquatic plants, from which emerge a few low islands. The area is extraordinarily rich in large herbivorous mammals, such as antelopes, water-hogs, hippopotamus, giraffes, elephants, rhinoceros, and so forth. Birds are also abundant, and the pools contain a tortoise, crocodiles, and large cat-fish. The vegetation is of the type characteristic of the Sudan, mingled with some more southern forms. Although rice succeeds well, and the burgu or sugar-producing plant is abundant, the country is sparsely populated, owing to the ravages of the Arabs. The inhabitants are Gullas, and have been able to persist only because of the marshy nature of the country and the periodical inundations which make access difficult. A fly called boguéné by the Arabs is common, and its bite is as fatal to domestic animals as that of the tsetse of Eastern Africa. The symptoms produced resemble those of trypanosoma.

POLAR.

The Antarctic Relief Expeditions.—As recorded in our last issue, the *Terra Nova* left Dundee roads on August 22 (not August 23 as stated) for Portland Harbour and the South. She arrived at Portland Harbour on the morning of August 26, and took on board a supply of coal, and also various consignments of stores, medical comforts, and scientific instruments. She carries provisions for eighteen months, and was towed out of Portland Harbour in the afternoon of August 26 by the cruiser *Minerva*, which took her to Gibraltar. There another cruiser (the *Vindictive*) took her in tow, and escorted her as far as Aden. From Aden the *Terra Nova* is to proceed to Hobart, Tasmania, where she will be met by the *Morning*, and the two relief ships will then endeavour to establish communication with the *Discovery*. If the last-named vessel be still in the same position, it is unlikely that the relief ships will reach her before February.

The French Antarctic Expedition in the *Français* sailed from Havre during August under the leadership of Dr. Charcot. Its first object is the relief of Nordenskjöld's expedition, believed to be fast in the ice off Graham's Land.

When this has been accomplished, a voyage will be made into the Antarctic Ocean, mainly for purposes of scientific research, for no effort will be made to establish a record. The expedition expects to be absent nearly two years, and is provisioned for twenty-eight months.

The Swedish Antarctic relief ship *Frithjof* left Stockholm on August 17. She stopped at Bremerhavn in order to take on board provisions for three years and wireless telegraphy apparatus. The Argentine relief ship, the *Uruguay*, is also to be fitted with similar apparatus, and it is expected that the vessel will remain outside the ice while the *Frithjof* will push on as far south as possible. From Bremerhavn the *Frithjof* went to Plymouth to coal, and thence she travels to Buenos Ayres *viâ* Madeira, where possibly an Argentine naval officer will join her. She will then go to Punta Arenas, whence her commander proposes to reach Snowhill, the supposed winter station of Nordenskjöld's expedition.

Baron Toll's Expedition.—A correspondent of the *Times* states that Lieut. Kolchak has started from the Arctic coast for the New Siberian Islands in search of Baron Toll, the head of the Russian Polar expedition which left St. Petersburg three years ago in the yacht *Zaria*. If Baron Toll be not found on the New Siberian Islands, then Lieut. Kolchak will endeavour to reach Bennett Island, about eighty miles further north-west. A year ago last May, as we have previously recorded, Baron Toll, with the astronomer Seeberg and two native Yakuts, left the *Zaria* off Kotlin Island with a view to reaching Bennett Island over the ice. In case the *Zaria* should not be able to follow them, which eventually turned out to be the case, the party hoped to be able to return independently to the New Siberian Islands: but it is supposed that Baron Toll had not dogs enough with him for this purpose, and was therefore obliged to winter on Bennett Island. In regard to food, all the members of his party are excellent hunters, and in case the baron should have succeeded in making his way back to the New Siberian Islands in the spring, he and his companions will have an ample supply of provisions in the stores which he himself left there for Nansen in 1893. According to notes left by Seeberg on New Siberia, which is the last news received of the expedition, Baron Toll's party must have left there about the beginning of July of last year to explore Bennett Island.

Canadian Arctic Expedition.—The Canadian Government steamer *Neptune* sailed on August 22 for Hudson's Bay and Arctic waters, on an expedition lasting a year and a half. The object of the expedition is to conduct, on behalf of the Government, a botanical, geological, and natural history investigation. The party will take formal possession of the Arctic Islands and the shore of Baffin's Bay. The commander of the expedition will report on the alleged extensive American poaching in the Hudson's Bay fisheries. The importance of the cod and halibut fisheries will be reported on, and a police station will be established at Chesterfield inlet.

GENERAL.

Meeting of Geographical Societies of France. A large party of delegates to the twenty-first annual meeting of French geographical and colonial societies held at Rouen during August paid a visit to London, and was received by the council of the Royal Geographical Society, and entertained at luncheon. Twenty-four French geographical societies, nine kindred societies, and three foreign geographical societies were represented at the Rouen Congress, and the members visiting England numbered eighty-two. At the luncheon, in responding to the toast of

"The Geographical Societies of France," proposed by the chairman, Major Leonard Darwin, M. Zévert, rector of the University of Caen, and president of the congress, said his claim to speak in that assembly was that he was the rector of a university, French in its character, founded by an English king, that he represented a city which was visited every year by hundreds of English people, and he was, moreover, the nephew of Pasteur speaking to a son of Darwin. Wherever the French had worked, and the English had followed, there had been great progress in civilisation and in the peaceful development of the human race. That was the spirit in which the delegates came to this country, and it was in that spirit they were welcomed.

British Rainfall Association.—It is announced that Mr. Sowerby Wallis has been compelled by ill-health to retire from his connection with this association, after having been connected with its work for thirty years. The organisation will be henceforth carried on under the sole charge of Dr. H. R. Mill, who has been for three years associated with Mr. Sowerby Wallis in the work.

NEW BOOKS.

The Place of Industries in Elementary Education. By Katharine Elizabeth Dopp. Chicago: The University of Chicago Press. London: P. S. King and Son, 1903.

The problem discussed in this little work may be briefly stated thus:—Granting that one of the most striking characteristics of society to-day is the marvellous development of its industries, and granting that young people ought to be put in possession of such experience as will fit them later on to take their part in these, in what way can this best be done without still further adding to the already overcrowded school curriculum? The author thinks that the solution is to be found in making more use, in the school, of the natural activities of the child as shown, first, in his play-impulses, and, a little later, in his instinct for construction, since both of these, as is now believed, reproduce, in idealised form, the serious activities in which the life of primitive man was spent. In pursuance of this idea, the first part of the book consists of an interesting survey of the different stages through which man has passed in the long course of his industrial development, from the primitive hunting and fishing stages, with their accompanying home industries, to the factory system of civilised nations to-day. In the remainder of the book, principles are laid down to guide teachers in making practical application of their knowledge of these attitudes and activities of early man, since these may be expected to reappear, in approximately the same sequence, in the child. Thus, to take one or two examples, appeal to his own experience and stories of primitive people will lead the child to see the need for tools, the different kinds required, and the ways in which these may have originated, his own penknife—so elaborate in spite of its seeming simplicity—forming a useful illustration in this connection. Similarly, the boy's bow and arrows and his toy boat raise the question, "What preliminary stages must have been passed through before such complex forms were arrived at?" So too the various forms of barter natural to children might serve as an introduction to the study of the first beginnings of trade, with all the problems that that involves. In these and many other ways the spontaneous activities and natural interests of the child may, by the skilful teacher, be turned to good

account, and the value of, among others, the earth-knowledge and geography lessons be greatly increased by being brought into closer connection with the everyday experience of the child.

Civilisation in Congoland: A Story of International Wrong-doing. By H. R. Fox Bourne. With a Map. P. S. King and Son, 1903.

The Truth about the Civilisation in Congoland. By a Belgian. With a Map. London: Sampson Low, Marston and Co., 1903.

Except for the two maps, one of Congoland by Bartholomew, and one showing the partition of the Congo Free State among Great Britain, Egypt, France, and Germany, as suggested by Captain Guy Barrow, these volumes have no geographical interest. The second is a hasty compilation of "refutations and explanations" in answer to the first. Mr. H. R. Fox Bourne is an accurate expert in African affairs as secretary of the Aborigines Protection Society. His representations to the British Foreign Office, culminating in this valuable historical volume, have led to questions and debates in the House of Commons, and to Lord Cranborne's official admission that a *prima facie* case for diplomatic inquiry has been made out. Accordingly, since 20th May last, Lord Lansdowne has been communicating with the other co-signatories in order to inquire into the two charges of the ill-treatment of natives and of the restrictions placed upon trade by the King of the Belgians, who is Sovereign of the State, from which he amasses great wealth and for which he is personally responsible.

The Geography of Disease. By Frank G. Clemow, M.D. Edin., D. Ph. Camb. Cambridge: At the University Press, 1903. "Cambridge Geographical Series." Pp. 624.

The study of the geographic distribution of disease over the world's surface is of comparatively recent date, but it is now progressing with some rapidity, and with benefit to the science of medicine. Dr. Clemow has performed a useful service in publishing this volume, which focuses in a readable form our present knowledge of the subject. During recent years the study of tropical diseases has been brought very prominently forward, and, following the example set in Edinburgh, London and Liverpool have now flourishing schools of medicine where special teaching is given in tropical medicine. Great Britain leads in this connection, and rightly so, for her Colonial possessions are the most important in the world. The study of the geographical and climatological and racial conditions which cause or favour the incidence or spread of disease is one of great fascination. It is also one of great difficulty, and requires considerable power of both research and detachment. It does not do to jump to conclusions, nor to be biassed by favourite theories. Surprises are of constant occurrence, and supposed "facts" are most liable to turn out error, either popular or otherwise. Malaria is one of the problems in which great change of opinion has taken place during recent years. The mosquito theory is now considered to be the only one to which attention need be paid, and yet it is not a final solution of the cause of malaria—for from whence does man, or the mosquito, obtain the micro-organism to which the disease is due? Why does the disease disappear in other regions? This is only one example of a difficult problem which the comprehensive study of the geographical distribution of disease in its widest sense may be expected sooner or later to solve.

Dr. Clemow's book will certainly prove very useful as a work of reference, and

after reading it with care we can commend it to all students. The author has been wise in not giving too great prominence to the general character and etiology of disease, matters which do not of necessity require elaborate discussion in a work of this kind. He is quite justified in keeping fairly closely to his main thesis. Nor does his method of classification matter at all; it has nothing to do with the main object for which the book is written. The maps published are good and useful; the list of principal authorities might perhaps have been lengthened with advantage.

Dreiunddreissig Jahre in Ost-Asien. By M. von Brandt, in drei Bänden. Leipzig: Georg Wigand, 1901.

Things Japanese. By Basil Hall Chamberlain. Fourth edition, enlarged and revised. London: John Murray, 1902. Pp. vi + 545.

To have lived in Japan for a series of years, and to have seen part of the political and social development which has brought a nation within a generation from a life of feudalism to a life of modern activity, are experiences which should colour the whole mental attitude of a man. Von Brandt and Chamberlain, the one a diplomatist, the other a philologist and student of *belles lettres*, have both had that privilege. Each in his own way gives his verdict on the island kingdom in the Far East. In the two volumes of the German diplomatist's reminiscences which lie before us we find one taken up with a description of his voyage to the East in 1860, his visits to Japan, China, Siam, and his return to Japan in 1862. The second volume covers twelve years of stay in the Mikado's empire, from 1862 to 1875, the years which saw the overthrow of the Shogunate, the establishment of the true emperor as a real ruler, the opening of the country to Western influences, the great Satsuma Rebellion, and the deliberate step taken by the ruling class of Japan to bring her into social and political line with the civilised Powers of the West. The reminiscences are evidently largely compiled from letters and documents written at the time, and have all the freshness of contemporary history. Most of what is related is familiar to students of the East; but a personal narrative by a trained mind witnessing many of the events chronicled has a historic interest of its own.

The book is of course mainly taken up with affairs of international import, and touches only incidentally on the customs and characteristics of the Japanese people. For information bearing on all sides of Japanese life we must turn to the pages of *Things Japanese*.

Mr. Chamberlain is one of our foremost authorities on Japanese Language and Literature, and held for some time the Chair on that subject in the Imperial University of Japan. He has lived continuously in the country for nearly thirty years; and, although his sojourn did not begin till after the great struggle, he has witnessed all the great movements since then. His book is a kind of encyclopædia arranged alphabetically for the sake of the inquirer, and brimful of all kinds of lore, ancient and modern, literary and scientific, political and social, military and artistic, and in short all the thousand and one things which make a people interesting. Though not intended as a guide-book, it could serve many of the purposes of such a book. Every traveller in Japan, since the first edition of the book appeared in 1890, has no doubt spent hours of the purest enjoyment reading its fascinating pages. For Mr. Chamberlain has the happy art of giving his information in a pleasant and sometimes humorous form. There are articles on Geography, Geology, Zoology, Botany, Earthquakes, in preparing which the author must have done a good deal of determined reading, for his own sympathies

lie rather in the direction of literature, language, mythology, and poetry. In an article on Sir Harry Parkes reference is made to vaccination, and attention drawn to a fact which twenty years ago impressed itself on every one who visited Japan. This was the prevalence of pox marks on many men and women above a certain age in all ranks of society, and the complete absence of these marks on the younger Japanese. There is of course no anti-vaccination agitation in Japan; they all live too near the days when smallpox was a scourge. In the article on *Torii*, the name of the peculiar gateway formed of two upright and two horizontal beams which stand in front of every Shinto temple, the various guesses as to the etymology of the word are discussed. Mr. Chamberlain regards the thing with the name as an importation from the continent of Asia. A suggestion given in conversation by Dr. Burgess may be worth referring to. When the nature of the *Torii* was described to Dr. Burgess, he at once said that it was probably the same as *Tōraṇ* (Hind.), *Toraṇa* (Sansk.), *Toraṇaṁ* (Pali), the modern use of the word being strings of flowers or garlands suspended across gateways on public festivals, also a temporary arch hung with drapery or festoons of flowers and leaves. In old literature the word means an arch, portals, triumphal arch, etc. The great stone gateways at Sāñchi in Bhopal are Tōrans. We commend this suggestion to Japanese philologists; it is extraordinary it was not made sooner. Almost every article in this brightly written book would offer material for discussion. Enough has been said to show its wide scope. It is an indispensable *vade mecum* to every intelligent traveller visiting Japan; and will give a better idea of Japanese life and history to all readers than many a more pretentious work. It could have been written only by a man saturated with all phases of Eastern life, and a close student of the people among whom he has lived for thirty years.

Guide-Annuaire de Madagascar et Dépendances. Année 1903. Tananarive: Imprimerie Officielle, 1903. Pp. 846.

Three years ago we noticed the *Guide à l'Immigrant à Madagascar*, a voluminous work containing information of every description. Scarcely less exhaustive is the present volume, which contains chapters on History, Physical Geography, etc., besides descriptions of the natural resources and capabilities of the country, mining laws, land grants, and other matters of especial importance to immigrants. Madagascar is a country of the future, and it is as yet uncertain what the French will make of it. The exports show on the whole a considerable increase during the last few years, but they are still small considering the natural capabilities of the country, which are undoubtedly great. On the other hand, the imports have increased in nearly as great a ratio, and their value is several times that of the exports. Is not this accounted for, in great part at least, by the cost of the garrison and administration? One thing the French have certainly done, they have diverted the greater part of the trade to the mother-country and its colonies. We wish we could follow their example in our own colonies and dependencies.

Sibérie et Californie. Par Albert Bordeaux. Paris: Libraire Plon, Plon-Nourrit et Cie., Imprimeurs-Editeurs, 8 Rue Garancière, 1903. *Price* 4 francs.

The Librairie Plon of Paris is apparently publishing a series of useful works for the information of its readers on a variety of commercial subjects. A short time ago we noticed a work published by them on the caoutchouc trade on the Amazon. In the volume now before us we have an account of the gold-mines of Siberia, based on a journey there last year; and the last hundred pages of the

book are devoted to reminiscences of gold-mining in California. During his six months' tour in Siberia, M. Bordeaux, as usual, met with every kindness and consideration at the hands of the Russian authorities; and he has collected together a good deal of information relating to the gold-mines of Siberia, their history, condition, and prospects, including the condition of the workers, which may be found useful to capitalists who contemplate trying their luck in a Siberian gold concession, or to philanthropists, who may venture on the arduous task of ameliorating the lot of the Russian miner. We are fain, however, to confess, that we found the last part of the book, *i.e.* that which deals with California, much more interesting than the part about Siberia. But in neither is there anything novel, at least to English readers, and the author does not attempt to grapple with the problems, either political or economical or social, with which gold-mining in Siberia and California is inseparably connected. The work may be useful as an introduction to other works, which deal with gold-mines in Siberia and California in a more serious and exhaustive way.

Chota Nagpore. By F. B. Bradley-Birt, B.A., I.C.S. London: Smith, Elder and Co. *Price* 12*s.* 6*d.*

This "little-known province of the Empire" is remarkably fortunate in having its story told as it has been told by Mr. Bradley-Birt, who has done for Chota Nagpore what Sir William Hunter did for Orissa. Indeed, so far as grace of style and eloquence of diction are concerned, the mantle of Sir William seems to have fallen on Mr. Bradley-Birt, and both writers possess in an equal measure the charm which arises from personal enthusiasm for, and sympathy with, the people and country they describe. As we read this book we cannot fail to observe that the writer is describing exactly what he has often seen and personally knows to be true. It would have been easy to write an account of Chota Nagpore which would rival the dryness and severity of a blue-book. But in Mr. Bradley-Birt's hands the interest of the subject never flags, and the reader closes the volume with regret. Perhaps the most interesting of the many races which are found in Chota Nagpore is the Fighting Kols, or Hos, who inhabit the open central plateau of Singbhum, and held their own for centuries against all comers until 1822, when after a prolonged struggle they acknowledged themselves conquered by the British. We quote some of Mr. Bradley-Birt's description of them as a good illustration of his felicitous choice of language and picturesque as well as accurate observation. "As far back as their annals go, they are found fighting, and always crowned with victory, driving back invaders or carrying war and devastation into the enemy's lands. They are a fine race, tall and well knit, stronger and more active than their neighbours, and with an undaunted courage and endurance found among no other race of Chota Nagpore. Living their own lives, free and unrestrained, in the jungles or on the hills of Singbhum, they developed all the best qualities of their kind, strength, courage, and endurance. . . . But, fine race as the Ho men are, they have to give way on many points to their womenfolk in stature and development. There is no mistaking the Ho women. None of their sex elsewhere in Chota Nagpore can compare with them. Generously built, tall, overtopping the men, and perfectly formed, with a free, graceful carriage, they are a splendid race. As they walk, stepping out with an unrestrained, independent air, swinging their arms and holding head and shoulders erect, they present a charming picture of unstudied grace of motion. They wear but one garment of long, coarse cloth, white with a red border, draped round the waist, and then caught up and thrown carelessly over the shoulder. It is a wonderfully becoming dress, showing off the figure to perfection, and leaving

all the limbs free, the long strip that hangs over the shoulder adding its touch of grace to all their movements. As a rule they wear few ornaments, save a string of coral round their necks, and the brass or silver bracelets and anklets that the native woman of the East is rarely found without. They have little love for the gaudy strings of beads so dear to the hearts of the Mundas and Oraons, and their ears and noses they are happily content to leave unadorned. All their art of decoration the Ho women reserve for their hair. Flowers only are used, and none that are bright and gay come amiss in the arrangement of the headdress. The hair is gathered up in a knot behind, which the Ho maiden does not scorn to enlarge artificially if Nature has not been sufficiently generous. The knot is worn on the right-hand side of the back of the head, and gives free scope for decoration. It is the most important part of their toilet, and they take elaborate pains to make it a success, revelling in the effects of the bright red of the palas and the cotton, or the pale yellow of the sal against the jet-black background of the hair. Thus simply and tastefully attired, they attend the dance, to meet with the admiration they deserve. . . . Quiet and well-mannered as the Hos are at all other times, there is one season of the year when they throw off all restraint, giving their primitive savage instincts full play. It is at the end of the harvest, when the work of the fields is done and the people are free to cease toil and celebrate the gathering in of their crops. Then, after the long spell of labour in the fields, they are ready to plunge into a whirl of pleasure, feeling, in their own words, 'full of devilry.' Intoxicated with excitement, they abandon themselves to a period of perfect riot and debauch. Men and women, old and young, alike let themselves go in pure reckless enjoyment of the moment, obeying the first impulse that comes uppermost in their minds without restraint. The result is a scene of wild orgy."

Chota Nagpore up to a short time ago was purely an agricultural tract, but within a dozen years one corner of it, viz. Jherria, has acquired an unexpected notoriety by the discovery of extensive coal-fields where now some thirty thousand coolies collected from far and wide are employed in extracting and handling the coal. The royalties of the mines amount to five lacs of rupees per annum, but had the Rajah had a competent manager in 1893, they would have amounted to twenty lacs. But we have said enough, we trust, to recommend this admirable work to our readers, and we have only to add that the book is equipped with an introduction by Lord Northbrook, a useful map, and several excellent photographs.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Handbook of Commercial Geography. By Geo. G. Chisholm, M.A., B.Sc., Edin. Fourth Edition, demy 8vo. Pp. xlvi+639. *Price* 15*s. net.* London: Longmans, Green and Co., 1903.

The Texts and Versions of John de Plano Carpini and William de Rubruquis as printed for the first time by Hakluyt in 1598, *together with some shorter pieces.* Edited by C. Raymond Beazley, M.A., F.R.G.S. Pp. xx+345. Demy 8vo. London: The Hakluyt Society, 1903.

St. Helena: the Historic Island from its discovery to the present date. By E. L. Jackson. Demy 8vo. Pp. iv+343. *Price* 6*s.* London: Ward, Lock and Co., Limited, 1903.

Jamaica as it is: 1903. By B. Pullen-Burry. Crown 8vo. Pp. xv + 240. *Price* 6*s.* London: T. Fisher Unwin, 1903.

Also the following Reports, etc. :—

Official Handbook of North-Eastern Rhodesia, 1903. With a Map. Fort Jameson: The British South Africa Company.

Commerce of Latin America: A Brief Statistical Review. Pp. 20. Philadelphia: Philadelphia Commercial Museum, 1903.

The Azores, St. Michael's as a Health Resort. Pp. 26. Ponta Delgada, St. Michael's, Azores: Society for Spreading Information about St. Michael's.

Notes on the Age of the South Central African Coal Field. By Dr. G. S. Corstorphine. Pp. 4. Johannesburg: South African Society, 1903.

Album de Aves Amazonicas, pelo Dr. Emelio A. Goeldi. 2nd Fasciculo (Estampas 13-24). Para, 1903.

Proceedings of the Royal Colonial Institute. Volume xxxiv., 1902-1903. Northumberland Avenue, London, W.C.

Bulletins of the Geological Survey of Victoria. No. I. The Geology of the Berry Lead at Spring Hill and Central Leads. By Professor J. W. Gregory, F.R.S., D.Sc. Victoria, 1903.

Catalogue of Canadian Birds. Part II. By John Macoun, M.A., F.R.S.C. Ottawa: Geological Survey of Canada, 1903.

Emigrazione e Colonie, Volume I. Europa, Part II. Francia. Pp. 344. Roma: Comm. dell' Emigrazione, 1903.

Rainfall of India. Twelfth Year, 1902. Calcutta: Meteorological Department Government of India, 1903.

Report of the Progress of the Ordnance Survey to the 31*st March* 1903. *Price* 4*s.* 8*d.* London, 1903.

Seventh Census of Western Australia. Compiled under the direction of Malcolm A. C. Fraser. Volume ii., Detailed tables. Perth, 1903.

Administration Report on the Railways in India for the year 1902. *Price* 2*s.* 8*d.* Simla, 1903.

Bulletin of the United States Geological Survey, Nos. 191-207. 14 Parts. Washington, 1903.

Mineral Resources of the United States, 1901. Washington: United States Geological Survey, 1902.

Bureau of American Ethnology. Bulletin 25. Washington: Smithsonian Institution, 1903.

United Coast and Geodetic Survey, List and Catalogue of the Publications issued by the United States Coast and Geodetic Survey, 1816-1902. Washington, 1903.

A Bibliography of Geodesy. Second Edition. By James Howard Gore, B.S., Ph.D. Washington: United States Coast and Geodetic Survey, 1903.

Deutsches Meteorologisches Jahrbuch für 1903. Jahrgang xiii. Bremen, 1903.

Report on Rainfall Registration in Mysore for 1902. Bangalore, 1903.

Publishers forwarding books for review will greatly oblige by marking the price *in clear figures, especially in the case of foreign books.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.[1]

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

INTRODUCTORY.

DURING the past season the survey of the Scottish fresh-water lochs has been continued with success. The bathymetrical survey of nearly all the principal lochs on the mainland, on the Orkneys, on the Shetlands, and on the Lews has now been completed; the field-work for the present year was brought to a close towards the end of October. Next spring the field-work will be again resumed, and it is believed that, in the course of a few months, the remaining lochs of Scotland will have been surveyed—at least all the lochs exceeding half a mile in length, on which there are rowing-boats.

During the past summer a small yacht was permanently anchored in 300 feet of water in Loch Ness, and connected with the shore by means of an electric cable. On board the yacht three cables were fitted up with platinum resistance thermometers, which could be lowered to varying depths; the temperature at these depths could then be recorded on shore. The results show very remarkable changes of temperature, especially at depths of 200 and 250 feet, apparently depending on the direction of the wind blowing over the surface of the loch. At the same time temperature observations have been carried out on board a small

[1] Continued from p. 479.

steam-yacht with the ordinary reversing thermometers, all along the length of the lake.

A large number of other physical observations have also been carried on, and the biologists have been examining in great detail the bathymetrical distribution of organisms in Loch Ness and some adjacent lochs. These observations will be continued at Fort Augustus during the coming winter by members of the Lake Survey staff, and the results will be published at a later date.

Part III.—Lochs of the Tay Basin.

The present communication deals with the lochs of the Tay basin, in continuation of the paper published in September last. The next

FIG. 1.—INDEX MAP OF THE TAY BASIN. BY J. G. BARTHOLOMEW, F.R.G.S.

paper, completing the account of the Tay basin lochs, will be published in January, and will be accompanied by a description of the geology of the region by Dr. John Horne, F.R.S., and Dr. B. N. Peach, F.R.S., and by a geological map.

Maps and Illustrations.

Plate I. shows Loch Tummel, the contour-lines of depth being drawn in at 25, 50, 75, 100, and 125 feet.

Plates II. and III. show Loch Tay in two portions, the contour-lines of depth being drawn in at 50, 100, 200, 300, 400, and 500 feet.

Plate IV. shows Lochs Derculich, Scoly, Ordie, na Craige, Kennard,

and Skiach, the contour-lines of depth being drawn in at 10, 25, and 50 feet.

Plate V. shows Lochs Broom, Essan, Lochan Breaclaich, Lochan na Lairige, Lochs Daimh and Giorra, the contour-lines of depth being drawn in at 5, 10, 25, 50, and 75 feet.

In addition to the maps, there are three woodcuts in the text: one showing the Tay basin on a small scale, the other two illustrating the scenery around Lochs Tummel and Tay.

7. *Loch Tummel.*

Loch Tummel is situated amid beautiful scenery, rock, wood, and water being combined in such a way as to present pictures of rare

FIG. 2. LOCH TUMMEL.
(Photo by J. Parsons, B.Sc.)

loveliness, the crests of Farragon, Meall Tarruinn Chon, and Schiehallion rising to great heights to the south and south-west. It contains large trout and a great many pike. Loch Tummel is two and three-quarter miles in length, with a maximum breadth of half a mile, the mean breadth being a little over one-third of a mile, or 13 per cent. of the length. Its waters cover an area of 630 acres, or rather less than one square mile. It drains directly an area of 62½ square miles, but since it receives the outflow from Lochs Rannoch, Laidon, Bà, etc., its total drainage-area is about 306 square miles, or 312 times the area of the loch. Nearly three hundred soundings were taken in Loch

Tummel, the maximum depth observed being 128 feet, or 4 feet more than the maximum depth recorded by Mr. Grant-Wilson, who took 123 soundings in 1888. The volume of water contained in the loch is estimated at 1,316,635,000 cubic feet, and the mean depth at 48 feet, or 37½ per cent. of the maximum depth. The length of the loch is 113 times the maximum depth, and 302 times the mean depth. The floor of Loch Tummel is irregular, falling into three deep basins separated by two ridges, the maximum depth on the westerly ridge being 52 feet and the maximum depth on the easterly ridge being 56 feet. The deepest of the three basins is situated near the west end of the loch, the maximum depth of 128 feet occupying a central position in this basin, but a short distance to the south a sounding of 74 feet is recorded in close proximity to a sounding of 127 feet. The 100-feet contour-line in this western basin is almost circular and nearly one-third of a mile in diameter; about one-fifth of a mile to the east is an isolated sounding of 102 feet, surrounded by shallower water. The central 100-feet basin is oblong in outline and nearly half a mile in length, the maximum depth of 119 feet having been observed towards the eastern end of the basin. The eastern basin just falls short of attaining a depth of 100 feet, the maximum observed being 99 feet; the 75-feet contour is approximately oblong in outline and nearly one-third of a mile in length. The 50-feet basin is a continuous area stretching from about a quarter of a mile from the west end to within 100 yards from the east end of the loch, and is nearly two and a half miles in length.

The area of the lake-floor covered by less than 50 feet of water is about 352 acres, or 56 per cent. of the entire area of the loch; the area covered by water between 50 and 100 feet in depth is about 217 acres, or 34½ per cent.; and that covered by more than 100 feet of water is about 60 acres, or 9½ per cent. of the total area of the loch.

Loch Tummel was surveyed on April 23 and 24, 1902, by Dr. Johnston, Mr. Parsons, Mr. Clark, and Mr. M'Intosh, the level of the surface of the water being found, by levelling from Ordnance Survey bench-mark, to be 454·5 feet above the sea. When levelled by the surveyors of the Ordnance Survey on June 26, 1860, the surface of the water was found to be 453·3 feet above sea-level.

The temperature of the surface water of Loch Tummel at 1.30 P.M. on April 23, 1902, was 43·2° F. (the air temperature at the time being 49·2°); at 9.45 A.M. on the next day (April 24) the surface temperature was 45·0° (air temperature 49·0°), and at 1 P.M. in the centre of the loch the surface temperature was 43·5°. A series of temperatures was taken below the surface at 1 P.M. on April 24, 1902, in 102 feet of water, with the following results:—

Surface,	. . . . .	43·5° F.
5 Feet,	. . . . .	43·5° „
10 „	. . . . .	43·4° „
20 „	. . . . .	43·2° „
50 „	. . . . .	43·0° „
70 „	. . . . .	42·6° „
100 „	. . . . .	42·4° „

showing a gradual decrease of temperature from surface to bottom, the range of temperature being 1·1° in the 100 feet of water.

About three miles to the south-west of Loch Tummel lies Loch Kinardochy,[1] a small hill loch containing pike, which flows into the River Tummel just before it enters Loch Tummel.

8. *Loch Tay.*

Loch Tay is one of the largest of the Scottish fresh-water lochs, unsurpassed in the beauty of its surroundings, and well-known to anglers on account of its salmon fishings, which are among the best in Scotland. It is also a good trout-fishing loch, having been much improved within recent years by being stocked with Loch Leven trout. The scenery around the loch is very fine,—grand and wild towards the south-west end, with the mighty Ben Lawers rising from its northern shores about half-way down the loch, becoming more sylvan in character towards the north-east end, a splendid view presenting itself to the eyes of a spectator from Kenmore Bridge (see Fig. 3).

Loch Tay is the largest loch in the basin of the River Tay, though Loch Ericht is a very formidable rival for this distinction, as will be seen from the following comparison :—

	Loch Tay	Loch Ericht.
Length,	14·55 miles.	14·5 miles.
Maximum breadth,	1·07 miles.	1·0 miles.
Mean breadth,	0·70 miles.	0·5 miles.
Superficial area,	10·19 square miles.	7·21 square miles.
Maximum depth,	508 feet.	512 feet.
Mean depth,	199·076 feet.	189·201 feet.
Volume of water,	56,550 million cub. ft.	38,027 million cub. ft.

This comparison shows that the maximum depth observed in Loch Ericht slightly exceeds that observed in Loch Tay, but in all other respects Loch Tay has the advantage, though as regards length and maximum breadth the two lochs are almost identical.

Loch Tay is over 14½ miles in length, and over one mile in maximum breadth, the mean breadth being nearly three-quarters of a mile, or nearly 5 per cent. of the length. Its waters cover an area of over 6500 acres, or over ten square miles, and it drains directly an area of about 187½ square miles, but since it receives the outflow from Lochs Dochart and Iubhair its total drainage-area is over 232 square miles, or nearly 23 times the area of the loch. Nearly one thousand soundings were taken in Loch Tay, and the maximum depth observed was 508 feet. The maximum depth recorded by Mr. Grant-Wilson in 1888, when he took

[1] = Loch of the End of the High Field.

415 soundings in Loch Tay, was 85 fathoms, or 510 feet. The volume of water contained in the loch is estimated at 56,549,745,000 cubic feet, or over one-third of a cubic mile, and the mean depth at 199 feet, or 39 per cent. of the maximum depth. The length of the loch is 151 times the maximum depth, and 386 times the mean depth.

Loch Tay trends in a north-east and south-west direction, being slightly sinuous in outline, somewhat like the italic letter *f*, as was noted in the case of Loch Iubhair, which flows into it. It is extremely simple in conformation, the bottom sloping gradually, without any pronounced irregularities, on all sides down to the deepest part, as is well shown on the longitudinal and cross sections on the map. The 50-feet basin approaches

FIG. 3. LOCH TAY, FROM KENMORE BRIDGE.
(*Photo by T. N. Johnston, M.B., C.M.*)

to within less than 400 feet from the south-west end and less than 800 feet from the north-east end, and is 14⅛ miles in length. The slope of the bottom is thus steeper at the south-west end than at the north-east end. In the former position a sounding of 65 feet was taken about 750 feet from shore, giving a gradient of 1 in 11½, and in the latter position a sounding of 80 feet was taken about 1075 feet from shore, giving a gradient of 1 in 13½. The 100-feet basin extends from about a quarter of a mile from the south-west end to about one-third of a mile from the north-east end, and is very nearly fourteen miles in length. The 200-feet basin stretches from about 1¼ miles from the north-east end to about 2½ miles from the south-west end, and is about eleven miles in length.

The main 300-feet basin approaches to within less than two miles from the north-east end, and is over 7½ miles in length; it is separated, by a slight shoaling of the bottom over an interval of about a mile, from a small subsidiary 300-feet basin (based upon soundings of 301 and 305 feet), which is over half a mile in length. The 400-feet basin is over 3½ miles in length, lying in the northern half of the loch, and approaching to about 3¾ miles from the north-east end. The deepest part of the loch lies between Skiag on the south-eastern shore and Cragganruar on the north-western shore, about 5½ miles from the north-east end of the loch, or about six miles by road from Kenmore, where there is a small basin over 500 feet in depth, two soundings of 508 feet being recorded about midway between the two shores.

The area of the lake-floor covered by less than 100 feet of water is estimated at about 1972 acres (over 3 square miles), or over 30 per cent. of the total area of the loch: the area between the 100-feet and 200-feet contour-lines is about 1532 acres (nearly 2½ square miles), or 23½ per cent.; the area between the 200-feet and 300-feet contours is about 1390 acres (over 2 square miles), or over 21 per cent.: the area between the 300-feet and 400-feet contours is about 1017 acres (over 1½ square miles), or 15½ per cent.; the area between the 400-feet and 500-feet contours is over 600 acres (rather less than one square mile), or over 9 per cent.; while the area covered by more than 500 feet of water is about 9 acres, or a small fraction of 1 per cent. of the entire area of the loch. These gradually decreasing areas between the contour-lines drawn in at intervals of 100 feet indicate that the average slope of the bottom becomes steeper and steeper on proceeding from the shore out into deep water; this is also clearly shown by a comparison of the two shallow zones on both sides of the 50-feet contour-line, the area between the shore and the 50-feet line being about 1161 acres, while the area between the 50-feet and 100-feet lines is about 811 acres, or respectively about 18 and 12½ per cent. of the total area of the loch. The slope of the bottom of the loch is shown on the natural scale and exaggerated five times on the longitudinal and cross sections on the map.

Loch Tay was surveyed on April 29 to May 7, 1902, by Sir John Murray, Dr. Johnston, Messrs. Parsons and James Murray, and the level of the surface of the water was determined by levelling from bench-marks as being 349·1 feet above the sea. The officers of the Ordnance Survey found the level to be 347·9 feet above the sea on August 12, 1899.

Many surface temperatures were taken during the progress of the survey from April 29 to May 7, 1902, the readings varying from 41·8° F. to 47·5°—a range of 5·7°. The higher readings, as a rule, were taken near shore, and the lower readings towards the centre of the loch over deep water. The air temperatures taken during the same period varied from 42·1° to 49·1°—a range of 7°. When visited on May 28, 1903, the surface temperature at noon about a mile from Kenmore was found to be 49·3°.

Two serial temperatures were taken beneath the surface in May 1902, and one series in May 1903, as given in the following table:—

Serial Temperatures taken in Loch Tay.

Depth (feet).	May 1, 1902. Off Ardtonaig.	May 6, 1902. Between Lawers and Fearnan, 4 P.M.	May 28, 1903. 1 mile west of Kenmore, noon.
	F.	F.	° F.
0	43·8	42·0	49·3
3	...	...	47·0
5	43·2	42·0	44·5
10	43·2	41·9	44·0
20	42·0	41·9	...
25	...	...	43·1
30	41·9	41·8	...
50	41·7	41·8	42·9
100	41·2	41·7	42·5
150	41·0	...	...
200	40·8	41·2	...
250	40·5	...	...
300	40·3	41·0	...
350	...	41·0	...

It will be seen that on May 1, 1902, the temperature of the water down to 30 feet was higher than on May 6, 1902, while from 50 feet downwards it was lower. The range of temperature between the surface and a depth of 300 feet on May 1 was 3·5° (from 40·3° to 43·8), while on May 6 it was only 1° (from 41° to 42°). On May 28, 1903, the temperature of the water was found to be considerably higher from the surface down to a depth of 100 feet than was observed in the previous May, the range of temperature in the upper 100 feet of water being 6·8° (from 42·5° to 49·3°).

9. *Some of the Smaller Lochs of the Tay Basin.*

Loch Derculich.[1]—Loch Derculich, situated in Strathtay amid beautiful scenery, affords good fishing, but is strictly preserved; it flows by the Derculich Burn into the River Tay to the north-east of Aberfeldy. It is surrounded by low rounded hills covered with heather, and there are few conspicuous boulders, but many small ones. To the north are high, steep hills (Farragon, etc.), with grey screes. The knoll forming the point at the boathouse on the south-eastern shore is high and planted with trees. The burn flows out of the loch by an artificial dam and sluice, which was open on the date of the survey, and the water in the loch was very low, a long gravelly point (not shown on the Ordnance Survey chart) appearing, and the island to the north was nearly, while the island to the south was quite, joined to the shore. Loch Derculich (pronounced Der'clich) is over half a mile in length from north to south, and also in maximum breadth from east to west, the mean breadth being over a quarter of a mile, or 45 per cent. of the length. Its waters cover an area of over 100 acres, or about one-sixth of a square mile, and it drains an area ten times greater—over 1½ square miles. About sixty

[1] =Loch of the Great Divers (the birds).

soundings were taken, the maximum depth observed being 70 feet. The volume of water is estimated at 108,333,000 cubic feet, and the mean depth at nearly 25 feet, or 35 per cent. of the maximum depth. The length of the loch is 44 times the maximum depth and 126 times the mean depth. A ridge crosses the loch at the narrowest part near the middle, the greatest depth on which is 34 feet. On both sides of this ridge the water deepens, the maximum depth in the southern basin being 45 feet, while the main deep basin lies to the north of the ridge, the maximum depth of the loch (70 feet) having been found less than a quarter of a mile from the north-eastern angle of the loch, where there is a small 50-feet basin about one-tenth of a mile in length; a short distance to the north-east is an isolated sounding of 50 feet, comparatively close to the north-east shore, separated from the 50-feet basin by a sounding of 38 feet. The 25-feet basin is a continuous area half a mile in length and over a quarter of a mile in breadth. The area of the lake-floor covered by less than 25 feet of water is about 53½ acres; that covered by water between 25 and 50 feet in depth is about 44½ acres; while that covered by more than 50 feet of water is about 2½ acres. Loch Derculich was surveyed on May 27, 1903, by Mr. James Murray; the elevation above the sea could not be determined. A series of temperatures was taken in the deepest part of the loch at 8 P.M. on May 27, 1903, with the following results:—

Surface, ...	55·0° F.
10 Feet, ...	51·0° „
15 „	49·0° „
25 „	47·7° „
50 „	47·1° „
65 „	47·0° „
70 „	47·0° „

(the air temperature at the time being 51·0°).

The range of temperature from surface to bottom was 8·0°, there being a fall of 4·0° between the surface and a depth of 10 feet, and a further fall of 3·3° between 10 and 25 feet. A comparison of these temperatures with those taken in Lochs Daimh and Giorra on the previous day shows that the water in Loch Derculich was much warmer from surface to bottom than in the two lochs referred to: at the surface the temperature was about 5°, and at 10 feet 3° to 4° higher; at the bottom it was 4° higher than at the bottom of Loch Daimh, and 1° higher than at the bottom of Loch Giorra at a much less depth. A short distance to the south-west of Loch Derculich lies Loch Glassie,[1] a small hill loch containing pike, which also flows into the River Tay near the entrance of the Derculich Burn. To the north-west of Loch Derculich lies Lochan a' Chait,[2] a little lochan which flows in the opposite direction into Loch Tummel.

Loch Scoly.—Loch Scoly, a small hill loch in Strathtay, lying to the north-east of Loch Kennard and west of Loch Skiach, and flowing by the Balnaguard Burn into the River Tay shortly before its junction

[1] =Loch of the Green Meadows. [2] =Loch of the Cat.

with the River Tummel, is over a quarter of a mile in length, with a maximum breadth of about one-eighth of a mile, the mean breadth being about one-sixteenth of a mile, or 21 per cent. of the length. Its waters cover an area of about 11½ acres, and it drains an area 13 times greater, or about a quarter of a square mile. Twenty-five soundings were taken, the maximum depth observed being 12 feet. The volume of water is estimated at 2,888,000 cubic feet, and the mean depth at nearly 5¾ feet, or 48 per cent. of the maximum depth. The length of the loch is 123 times the maximum depth, and 258 times the mean depth. The loch forms a simple basin; the deeper water is found towards the southern end, the three soundings exceeding 10 feet being centrally placed in the southern half of the loch. Only three soundings were taken under 5 feet close to the shore, so that the slope of the bottom is on the whole moderately steep. The area of the lake-floor covered by less than 10 feet of water is over 10 acres, or 88 per cent. of the total area of the loch, and only a small proportion of this area is covered by less than 5 feet of water. Loch Scoly was surveyed on May 29, 1903, by Mr. James Murray. The temperature of the surface water was 63·0° F., and a reading at 5 feet gave the same result, while a reading at 10 feet gave 56·0 —a fall of 7·0° in the temperature, of the water at 10 feet as compared with that at 5 feet.

Loch Ordie.—Loch Ordie is a very pretty loch situated amid grouse-moors to the east of the River Tay, and surrounded by wooded hills; it is a good trouting loch, but strictly preserved. It receives the outflow from two little lochs lying among the hills to the north—Lochan Oisinneach Bheag [1] and Lochan Oisinnic Mhor [2]—and flows into the River Tay near Dalguise. It trends in an east and west direction, being widest towards the west end and narrowing somewhat towards the east end. It is nearly two-thirds of a mile in length, and nearly half a mile in maximum breadth, the mean breadth being over a quarter of a mile, or 44 per cent. of the length. Its waters cover an area of about 116 acres, or nearly one-fifth of a square mile, and it drains an area nearly 24 times greater—over 4¼ square miles. Sixty-five soundings were taken, the maximum depth observed being 69 feet. The volume of water is estimated at 133,110,000 cubic feet, and the mean depth at 26⅓ feet, or 38 per cent. of the maximum depth. The length of the loch is 49 times the maximum depth, and 128 times the mean depth. Loch Ordie is extremely simple in conformation, the bottom sinking gradually on all sides down to the greatest depth, which is approximately centrally placed, though rather nearer the west than the east end. The 25-feet basin is about two-fifths of a mile in length and over a quarter of a mile in maximum width, while the 50-feet basin is about a quarter of a mile in length and one-seventh of a mile in maximum width. The area of the lake-floor covered by less than 25 feet of water is about 66 acres, or 57 per cent. of the total area of the loch; that covered by water between 25 and 50 feet in depth is about 34 acres, or

[1] =The Little Cornered Loch (*i.e.* having bays or nooks).
[2] =The Big Cornered Loch.

29 per cent.; while that covered by over 50 feet of water is about 16 acres, or 14 per cent. of the entire area of the loch. Loch Ordie was surveyed on June 3, 1903, by Mr. James Murray, and the level of the surface of the water was determined by levelling from bench-mark as being 946·3 feet above the sea. Serial temperatures taken in the deepest part of the loch gave the following results:—

Surface,	57·6° F.
10 Feet,	55·3° „
15 „	49·5 „
25 „	47·1° „
50 „	45·7° „
68 „	45·4 „

The range of temperature from surface to bottom was 12·2°, there being a fall of 5·8° between 10 and 15 feet.

Loch na Craige.[1]—Loch na Craige (or na-Craig), one of the best trout lochs in the district, is situated in Strathtay about three miles to the south-east of Aberfeldy, and flows into the River Bran by the Cochill Burn, which also receives the outflow from Loch Hoil. It is surrounded by low, heather-clad hills covered with stony debris. It is nearly half a mile in length, nearly one-eighth of a mile in maximum breadth, the mean breadth being about one-twelfth of a mile, or 16 per cent. of the length. The waters of the loch cover an area of about 24 acres, and it drains an area fourteen times greater, or more than half a square mile. Nearly thirty soundings were taken, the maximum depth observed being 13 feet. The volume of water is estimated at 7,871,000 cubic feet, and the mean depth at nearly 7½ feet, or 57 per cent. of the maximum depth. The length of the loch is 195 times the maximum depth, and 342 times the mean depth. Loch na Craige is a long, narrow depression trending in a north-west and south-east direction, or nearly north and south. It forms a simple basin, the deep water running along the centre of the loch, the area covered by more than 10 feet of water being over one-third of a mile in length, but it is rather curious to note that the maximum depth of 13 feet was found at the extreme southern end of the 10-feet basin and comparatively very close to the southern shore. The slope of the bottom is thus pretty steep here, and in other places the slope is steep; for instance, two soundings of 11 feet were taken about sixty feet from shore, one off the western and one off the eastern shore, giving a slope of 1 in 5·5. About 63 per cent. of the lake-floor, or about 15¼ acres, is covered by less than 10 feet of water. Loch na Craige was surveyed on May 29, 1903, by Mr. James Murray, who determined the elevation of the surface of the water by levelling from bench-mark as being 1297·3 feet above the sea. Temperatures were taken in the deepest part of the loch, with the following results:—

Surface,	60·0° F.
5 Feet,	60·0° „
10 „	56·5° „

(the air temperature at the time being 63·0°).

[1] = Loch of the Rock

Loch Kennard.[1]—Loch Kennard, a good fishing loch abounding with small trout, is situated in Strathtay, and flows into the River Bran by the Ballinloan Burn. Its shores are nearly all wooded, and where not planted with trees the low hills are covered with heather. It is peculiar in outline, somewhat resembling that of a young mushroom, the stem pointing west and the apex of the crown pointing north-east. It is over two-thirds of a mile in length, and over one-third of a mile in maximum breadth, the mean breadth being over one-sixth of a mile, or 26 per cent. of the length. Its waters cover an area of about 77 acres, or nearly one-eighth of a square mile, and it drains an area seven times greater, or nearly nine-tenths of a square mile. Nearly fifty soundings were taken, the maximum depth observed being 72 feet. The volume of water is estimated at 108,439,000 cubic feet, and the mean depth at $32\frac{1}{4}$ feet, or 45 per cent. of the maximum depth. The length of the loch is 50 times the maximum depth and 111 times the mean depth. Loch Kennard forms a simple basin, with here and there minor undulations of the bottom. The deepest water (72 feet) is found in the centre of the widest part of the loch, to the east of the constriction in its outline; in the middle of this constriction a depth of 70 feet was found, but immediately to the west the bottom rises to 50 feet beneath the surface, and falls again farther west to a depth of 63 feet. The 25-feet basin is half a mile in length and over a quarter of a mile in maximum width, while the 50-feet basin is over one-third of a mile in length. The area of the lake-floor covered by less than 25 feet of water is nearly 30 acres, or 38 per cent. of the entire area of the loch; that covered by water between 25 and 50 feet in depth is about 33 acres, or 43 per cent.; while that covered by more than 50 feet of water is over 14 acres, or 19 per cent. of the total area of the loch. These figures show that the average slope is steeper between the shore and the 25-feet contour-line than between the 25-feet and 50-feet contours. Loch Kennard was surveyed on May 29, 1903, by Mr. James Murray, who was unable to determine the elevation of the surface of the water above the sea. Temperatures were taken in the deepest part of the loch, with the following results:—

Surface,	56·7° F.
5 Feet,	51·0 „
10 „	48·3° „
25 „	46·0° „
50 „	45·5 „
72 „	45·3 „

(the air temperature at the time being 60·0°).

The range in the temperature of the water from surface to bottom was thus 11·4°, the fall of temperature between the surface and a depth of 5 feet amounting to 5·7°, that between 5 and 10 feet amounting to 2·7°, and that between 10 and 25 feet to 2·3°. A comparison of these temperatures with those taken in Loch Derculich two days previously shows that the temperature of the whole body of water in Loch Kennard was lower than that in Loch Derculich (except at the surface—which may

[1] =Loch of the High Point.

be due to the fact that the observations in Loch Kennard were made in the early afternoon, while those in Loch Derculich were taken in the late evening).

Loch Skiach.[1]—Loch Skiach, situated in Strathtay, containing large trout as well as pike, flows into Little Loch Skiach (which was not sounded) by a short burn with a slight fall, and thence by the Pitleoch Burn into the Ballinloan Burn shortly before it joins the River Bran. It is surrounded by low rounded, heather-clad hills with scattered boulders, and the shores are of clean shingle with boulders. It is very irregular in outline, the longer axis being nearly north and south, and the bottom is also irregular. It is over three-quarters of a mile in length, and nearly half a mile in maximum breadth, the mean breadth being nearly one-fifth of a mile, or 25 per cent. of the length. Its waters cover an area of about 98 acres, or over one-seventh of a square mile, and it drains an area six times greater—an area of nearly one square mile. Eighty-five soundings were taken in Loch Skiach, the maximum depth observed being 55 feet. The volume of water is estimated at 77,185,000 cubic feet, and the mean depth at 18 feet, or 33 per cent. of the maximum depth. The length of the loch is 75 times the maximum depth, and 228 times the mean depth. Near the middle a ridge crosses the loch from south-east to north-west, on which the depth is less than 20 feet; this ridge separates the two deep basins, of which the southerly one is the deeper, the maximum depth of 55 feet having been recorded about a quarter of a mile from the southern end of the loch, while the greatest depth recorded in the northern basin was 45 feet in two places. The two 25-feet basins are each under a quarter of a mile in length. Near the middle of the loch the slope of the bottom is very steep in places;—for instance, a sounding of 33 feet was taken off the eastern shore at a distance of about 100 feet, giving a slope of 1 in 3, and a sounding of 26 feet about the same distance off the western shore gives a slope of 1 in 3·8. The area of the lake-floor covered by less than 25 feet of water is about 77 acres, or 79 per cent. of the total area of the loch; that covered by water between 25 and 50 feet in depth is about 20 acres, or 20 per cent.: while that covered by more than 50 feet of water is only about $1\frac{1}{4}$ acres, or 1 per cent. Loch Skiach was surveyed on June 12, 1903, by Mr. James Murray, and the level of the surface of the water was determined by levelling from bench-mark as being 1385·7 feet above the sea. The temperature of the surface water on commencing the survey at 9 A.M. on June 12, 1903, was 59·0° F. (the air temperature at the time being 53·0°). Later in the day serial temperatures were taken in the deepest part of the loch, with the following results:—

Surface, ...	60·0° F.
10 Feet, ...	59·0° ,,
15 ,, ...	55·3° ,,
20 ,, ...	49·2° ,,
30 ,, ...	49·0° ,,
45 ,, ...	48·0 ,,
55 ,, ...	47·5° ,,

[1] =Loch of Thorns.

The range in the temperature of the water from surface to bottom was thus 12·5°; between the surface and a depth of 10 feet the fall was only 1°, but between the depths of 10 and 20 feet the fall of temperature amounted to nearly 10°—3·7° between 10 and 15 feet and 6·1° between 15 and 20 feet. These readings are all higher than those taken in Lochs Kennard and Derculich about a fortnight earlier in the season.

Loch Broom.—Loch Broom, a fine trout loch, but strictly preserved, lies to the east of the River Tummel, into which it flows by the Lochbroom Burn to the north of Ballinluig, before the River Tummel joins the River Tay. It is nearly three-quarters of a mile in length, and over one-third of a mile in maximum breadth, the mean breadth being nearly one-fifth of a mile. Its waters cover an area of about 86 acres, or over one-eighth of a square mile, and it drains an area of 3½ square miles—an area 26 times greater than the area of the loch. Over sixty soundings were taken in Loch Broom, the maximum depth observed being 9 feet. The volume of water contained in the loch is estimated at 18,813,000 cubic feet, and the mean depth at 5 feet, or 56 per cent. of the maximum depth. The length of the loch is 422 times the maximum depth, and 757 times the mean depth.

Loch Broom is very shallow, being simply a large bog-hole, or depression in the moorland, with shores of yellow sandy debris covered by peat, and all heather clad. The outflow is over a dam about 5 feet high, so that the greater part of the loch must be artificial. Where the depth is less than 5 feet the bog-bean is everywhere seen, and there are numerous islets—some of peat, others chiefly of bog-bean—on several of which gulls nest. The deeper water (over 5 feet) lies to the east and north of the islets, the maximum depth of 9 feet having been observed in several places towards the eastern shore; along the western shore and around the islets the bottom is covered by less than 5 feet of water, but at the outflow, where the waters of the loch pass into Lochbroom Burn, two soundings of 5 feet were taken. The area of the lake-floor covered by less than 5 feet of water is about 38 acres, or 44 per cent. of the entire area of the loch, while that covered by more than 5 feet of water is about 48 acres, or 56 per cent. Loch Broom was surveyed on June 11, 1903, by Mr. James Murray, but the elevation above the sea could not be determined. Drift-marks were observed 3 feet above the level of the water on the date surveyed.

The temperature of the surface water on commencing the survey at noon on June 11, 1903, was 60·0° F., and two readings in open water—one at the surface and one at a depth of 8 feet—gave in each case 60·8° (the air temperature being 51°).

Loch Essan.[1]—Loch Essan (or Easain), a hill loch lying to the north of Loch Dochart, containing dark-coloured trout of rare quality, but strictly preserved, flows by the Allt Essan into the River Dochart after it leaves Loch Iubhair. It is nearly half a mile in length, and over one-fifth of a mile in maximum breadth, the mean breadth being about one-ninth of a mile. Its waters cover an area of about 32 acres, and it

[1] = Loch of the Waterfalls.

drains an area of over $1\frac{1}{2}$ square miles—an area 32 times greater than the area of the loch. Over forty soundings were taken in Loch Essan, the maximum depth observed being 18 feet. The volume of water is estimated at 9,664,000 cubic feet, and the mean depth at nearly 7 feet, or 38 per cent. of the maximum depth. The length of the loch is 135 times the maximum depth, and 356 times the mean depth. The loch trends in an east and west direction, and is very irregular in outline. The bottom is also irregular, forming three small basins with depths exceeding 10 feet, the westernmost being the deepest, the maximum depth of 18 feet having been observed about one-sixth of a mile from the west end of the loch. To the east of this western deep basin, and near the centre of the loch, lies a heap of stones around which soundings of 6 feet were taken. A little farther to the east lies the central 10-feet basin, based on a sounding of 11 feet. To the east of the central basin there is a constriction in the outline of the loch in which soundings of 7 and 8 feet were taken, and on approaching the east end the loch widens out, and the bottom sinks to form the third (eastern) 10-feet basin, the maximum depth in which is 16 feet. To the south of this eastern basin is a small island, the passage between the island and the shore being obstructed by weeds, and weeds are also abundant along the northern shore. The area of the lake-floor covered by less than 10 feet of water is about 26 acres, or 81 per cent. of the total area of the loch, while that covered by more than 10 feet of water is about 6 acres, or 19 per cent. Loch Essan was surveyed on June 16, 1903, by Mr. James Murray, who estimated the elevation of the surface of the water as being about 1440 feet above sea-level.

About half a mile to the south-west of Loch Essan lies the little Loch Maragan, which flows by the Allt Inverhaggernie into the River Fillan before it enters Loch Dochart.

Lochan Breaclaich.[1]—Lochan Breaclaich (or Loch-an-Breacklaich), a hill loch containing fine trout, flows into Loch Tay near its south-west end by the Allt na Breaclaich. It is peculiar in outline, somewhat resembling the capital letter Y, a promontory of land projecting into the loch from the eastern shore opposite the inlet on the western shore which leads to the outflow. The length of the loch from north-east to south-west in a straight line is about half a mile, but a line following the axis of deep water would be considerably over half a mile in length. The maximum breadth is about one-third of a mile, and the mean breadth about one-seventh of a mile. Its waters cover an area of about 43 acres, and it drains an area twenty times greater, or about $1\frac{1}{3}$ square miles. About sixty soundings were taken in Lochan Breaclaich, the maximum depth observed being 41 feet. The volume of water is estimated at 26,619,000 cubic feet, and the mean depth at 14 feet, or 34 per cent. of the maximum depth. The length of the loch is 64 times the maximum depth, and 187 times the mean depth. The bottom of the loch is fairly regular, sinking, to the north and south of the promontory referred to, into two basins with depths exceeding 25 feet, occupying the arms,

[1] =Speckled Loch.

as it were, of the letter Y, while the shank of the letter, leading to the outflow, is occupied by shallower water. Of the two deep basins the northern one is the larger and deeper, the maximum depth of 41 feet having been found approximately in the centre of this basin, but towards the north-western shore, while the southern basin is based upon soundings of 32 and 26 feet. The 10-feet basin is a continuous area extending from close to the north-eastern end to near the south-western end, and occupying the greater portion of the loch. The area of the lake-floor covered by less than 10 feet of water is over 19 acres, or 45 per cent. of the total area of the loch, while that covered by more than 10 feet of water is nearly 24 acres, or 55 per cent. Lochan Breaclaich was surveyed on June 16, 1903, by Mr. James Murray, but the elevation of its surface above the sea could not be determined.

The temperature of the surface water on commencing the survey at 2 P.M. on June 16, 1903, was 57·0° F. (the air temperature being 58·0). Serial temperatures taken in the deepest part of the loch gave the following results:—

Surface,	57·5° F.
5 Feet,	57·5° „
10 „	57·4 „
15 „	51·2° „
20 „	49·3° „
40 „	48·0° „

It will be observed that the range of temperature from surface to bottom amounted to 9·5°, and that the fall of temperature between the depths of 10 and 15 feet amounted to 6·2°.

Lochan na Lairige.[1]—Lochan na Lairige lies to the west of Ben Lawers and flows into Loch Tay by the Allt a' Mhoirneas, which enters the loch nearly opposite the entrance of the Allt na Breaclaich. It trends in a north and south direction, and is extremely simple in outline and conformation; it is oblong in outline, and of nearly uniform width throughout. It is nearly three-quarters of a mile in length, and over one-eighth of a mile in maximum breadth, the mean breadth being one-tenth of a mile, or 14 per cent. of the length. Its waters cover an area of about 47½ acres, and it drains an area 16 times greater, or about 1⅛ square miles. Over forty soundings were taken, the maximum depth observed being 39 feet. The volume of water is estimated at 22,682,000 cubic feet, and the mean depth at 11 feet, or 28 per cent. of the maximum depth. The length of the loch is 99 times the maximum depth, and 350 times the mean depth. The northern portion of the loch is shallow, the water deepening gradually on proceeding southwards until the maximum depth is encountered about one-eighth of a mile from the southern end, thence the water shallows rapidly towards the south end. The 10-feet basin is about half a mile in length, extending from near the south end to within one-sixth of a mile from the north end. The

[1] = Loch of the Homestead.

25-feet basin is contained in the southern half of the loch, and is about a quarter of a mile in length. The area of the lake-floor covered by less than 10 feet of water is over 29 acres, or 62 per cent. of the entire area of the loch, while that covered by more than 10 feet of water is over 18 acres, or 38 per cent., of which 8 per cent. exceeds 25 feet in depth. Lochan na Lairige was surveyed on June 16, 1903, by Mr. James Murray, who estimated that the surface of the water was about 1595 feet above the level of the sea.

To the north-east of Lochan na Lairige lies the little Lochan a' Chait[1] on the eastern flanks of Ben Lawers; it flows into Loch Tay by the Lawers Burn.

Lochs Daimh and Giorra, situated in the wilds of Glenlyon, amid grand and mountainous scenery, are good trouting lochs, but strictly preserved. Loch Daimh flows into Loch Giorra by a short river, and the outflow from both lochs is carried into the River Lyon by the Allt Conait. To the south, on the flanks of Stuchd an Lochain, lies the small Lochan nan Cat,[2] at an elevation of over 2000 feet above the sea, which flows into the river between Lochs Daimh and Giorra. It being reported that this little lochan was frozen over a few days before the date of the survey of Lochs Daimh and Giorra, it was visited in the hope of taking soundings through holes in the ice, but the ice had disappeared. It was apparently shallow all round the shore, except where there are screes from the cliffs, and, if at all deep, it must be over a very limited area. The temperature of the water was 53·0° F. (the air temperature being 55·0°), while a reading taken close under the crags beside the snow gave 49·8°.

Loch Daimh.—Loch Daimh (or Damh) trends in an east and west direction, being widest and deepest towards the west end, narrowing and shallowing towards the east end. It is nearly a mile in length, and nearly one-third of a mile in maximum breadth, the mean breadth being nearly one-fifth of a mile, or 19 per cent. of the length. Its waters cover an area of about 111 acres, or over one-sixth of a square mile, and it drains an area nearly 30 times greater, or over 5 square miles. Nearly sixty soundings were taken, the maximum depth observed being 95 feet. The volume of water is estimated at 189,623,000 cubic feet, and the mean depth at 39 feet, or 41 per cent. of the maximum depth. The length of the loch is 53 times the maximum depth and 130 times the mean depth. The loch is of simple conformation, and, on the whole, comparatively deep, only half a dozen soundings under 10 feet being recorded close to the shore. Off the northern shore, towards the west end, the slope of the bottom is very steep, soundings of 31 feet and 44 feet having been taken about 80 and 100 feet from shore respectively; this is equal to a slope of 1 in 2·3 to 2·6. The eastern end, and south-eastern portion of the loch around the island, are comparatively shallow. The 25-feet basin is about three-quarters of a mile in length, stretching from quite close to the west end to within one-sixth of a mile from the east end. The 50-feet basin is nearly half a mile in length, and the 75-feet basin, occupying the western half of the loch, is over

[1] =Loch of the Cat.

[2] =Loch of the Stags.

one-third of a mile in length. The maximum depth of 95 feet was observed in two places approximately near the centre of the wide western portion of the loch. The area of the lake-floor covered by less than 25 feet of water is about 50½ acres, or over 45 per cent. of the total area of the loch; that covered by water between 25 and 50 feet in depth is about 21½ acres, or over 19 per cent.; that covered by water between 50 and 75 feet in depth is about 19 acres, or 17 per cent.; and that covered by more that 75 feet of water is about 20½ acres, or over 18 per cent. of the entire area of the loch. The flat-bottomed character of the deep western portion of the loch is well brought out by a comparison of the last two percentages, while the high percentage of the bottom covered by less than 25 feet of water is due to the comparatively large shallow area in the south-eastern and eastern part of the loch.

Loch Daimh was surveyed on May 26, 1903, by Mr. James Murray, but the level of the surface of the water above the sea could not be determined. The temperature of the surface water on commencing the survey at 9.30 A.M. on May 26, 1903, was 51·0° F. (the air temperature being 64·0°), and a series of temperatures taken in the deepest part of the loch gave the following results:—

Surface,	50·3° F.
10 Feet,	47·0° „
25 „	44·0° „
50 „	43·5° „
90 „	43·0° „

The range in the temperature of the water from surface to bottom was thus 7·3°. The fall of temperature from the surface to a depth of 10 feet amounted to 3·3°, and that between the depths of 10 and 25 feet amounted to 3·0°, and below 25 feet the fall amounted to 1·0°.

Loch Giorra.[1]—Loch Giorra (or Girre) trends almost east and west; there is a slight bend near the middle of the loch, the eastern half trending north-west and south-east. It is over four-fifths of a mile in length, with a maximum breadth of over a quarter of a mile, the mean breadth being about one-sixth of a mile, or 20 per cent. of the length. Its waters cover an area of about 88½ acres, or less than one-seventh of a square mile, and it drains directly an area of over 5½ square miles, but, since it receives the outflow from Loch Daimh, its total drainage area is over 10¾ square miles—an area 78 times greater than the area of the loch. Fifty-five soundings were taken in Loch Giorra, the maximum depth observed being 49 feet. The volume of water is estimated at 83,686,000 cubic feet, and the mean depth at nearly 22 feet, or 44 per cent. of the maximum depth. The length of the loch is 88 times the maximum depth, and 200 times the mean depth.

The floor of Loch Giorra is rather irregular. The deepest part is in the western half, the maximum depth of 49 feet having been observed about one-sixth of a mile from the west end. The 25-feet basin in this

[1] =Short Loch (*i.e.* shorter of two).

part of the loch is about two-fifths of a mile in length, and towards the east end there is a second 25-feet basin about one-fifth of a mile in length, in which the maximum depth is 40 feet. These two basins are separated by a remarkable rise of the bottom, on which depths of 15 and 18 feet were recorded, surrounded on all sides by deeper water. The area of the lake-floor covered by less than 20 feet of water is nearly 43 acres, or over 48 per cent. of the total area of the loch; that covered by water between 20 and 40 feet in depth is nearly 38 acres, or about 42½ per cent.; while that covered by more than 40 feet of water is over 8 acres, or over 9 per cent. Loch Giorra was surveyed on the same day as Loch Daimh, May 26, 1903, by Mr. James Murray; its elevation above the sea could not be determined. A series of temperatures taken in the deepest part of the loch gave the following results:—

Surface, ...	50·0° F.
10 Feet, ...	48·0° „
25 „	46·8° „
45 „	46·0° „

(the air temperature at the time being 53·0°).

A comparison of these temperatures with those taken in Loch Daimh later in the day shows that, while the surface temperature in each loch was nearly identical, the temperature of the water beneath the surface was lower in the deeper loch: thus at 10 feet the temperature in Loch Daimh was 1·0° lower than in Loch Giorra, at 25 feet it was 2·8° lower, and at 50 feet it was 2·5° lower than at 45 feet in Loch Giorra.

The particulars regarding the different lochs dealt with in this paper are collected together in the table on the following page for convenience of reference and comparison.

From this table it will be seen that in the fourteen lochs under consideration 1838 soundings were taken, and that the aggregate area of the water surface is about 12½ square miles, so that the average number of soundings per square mile of surface is 147. The aggregate volume of water contained in the lochs is estimated at about 58,657 millions of cubic feet. The area drained by these lochs is about 568¾ square miles, or nearly 46 times the area of the lochs.

SUMMARY TABLE

Giving details concerning the lochs described in this paper.

Loch.	Height above sea. Feet.	Number of Soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. feet	Mean feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Tummel	454·5	289	2·75	0·50	0·36	13·1	128	48·030	37·5	113	302	1,317	0·98	306·06	312·31
Tay	349·1	924	14·55	1·07	0·70	4·8	508	199·076	39·2	151	386	56,550	10·19	232·06	22·77
Dereulich	...	59	0·59	0·59	0·27	45·1	70	24·717	35·3	44	126	108	0·16	1·57	10·00
Broom	...	62	0·72	0·34	0·19	26·0	9	5·020	55·8	422	757	19	0·13	3·53	26·34
Essan	1440·0	41	0·46	0·21	0·11	23·7	18	6·820	37·9	135	356	10	0·05	1·60	32·00
Lochan Breaclaich	...	59	0·49	0·33	0·14	28·2	41	14·088	34·4	64	187	27	0·07	1·35	19·85
Lochan na Lairige	1595·0	43	0·73	0·13	0·10	13·7	39	10·970	28·1	99	351	23	0·07	1·16	15·67
Daimh	...	56	0·96	0·31	0·18	18·8	95	39·117	41·2	53	130	190	0·17	5·13	29·48
Giorra	...	55	0·82	0·26	0·17	20·5	49	21·701	44·3	88	200	84	0·14	10·78	78·10
Scoly	...	25	0·28	0·12	0·06	21·4	12	5·724	47·7	123	258	3	0·02	0·23	12·77
Ordie	946·3	65	0·64	0·48	0·28	43·8	69	26·324	38·2	49	128	133	0·18	4·28	23·64
Na Craige	1297·3	27	0·48	0·13	0·08	16·5	13	7·420	57·1	195	342	8	0·04	0·54	14·21
Kennard	...	47	0·68	0·36	0·18	26·2	72	32·266	44·8	50	111	108	0·12	0·88	7·27
Skiach	1385·7	85	0·78	0·44	0·20	25·1	55	18·090	32·9	75	228	77	0·15	0·94	6·14
		1838										58,657	12·47	568·72[1]	45·60

[1] It must be remembered that the drainage area of Loch Tay includes the areas draining into Lochan Breaclaich and Lochan na Lairige, and that the Loch Giorra drainage area includes that of Loch Daimh.

SAND-BURIED RUINS OF KHOTAN.[1]

In the *Magazine* for July of last year we had much pleasure in recommending to the perusal of our readers the "Preliminary Report on a Journey of Archæological and Topographical Exploration in Chinese Turkestan," by Mr. M. A. Stein, of the Indian Educational Service, and we indicated our opinion that the detailed reports, when issued, would be found full of interest to geographers, numismatists, ethnographers, etc. Thanks to the brilliant success achieved by Mr. Stein in his arduous and adventurous undertaking, the work of examining, comparing, cataloguing, and classifying the many treasures he has succeeded in landing safely in the British Museum will task the best energies and skill of even the Museum staff, and we cannot look for the detailed and scientific reports for a long time, possibly for years. When the treasures are ready for the inspection, criticism, and consideration of the experts of all nations, we may expect much conflict of opinion and diversity of conclusions, and in all probability part of the history of the tract, which we now call Chinese Turkestan, will have to be rewritten. There will, however, be no diversity of opinion on one point, viz., the debt of obligation under which Mr. Stein has placed all who are interested in antiquarian research. In the meantime Mr. Stein has, with the consent of the Government of India, published what we may call a popular account of his expedition, and it is this work, which he very appropriately calls "Sand-buried Ruins of Khotan," to which we now invite attention. It appeals to all, who, though not experts, are interested in the geography, archæology, numismatics, and antiquities of the East, and it is sure of a cordial welcome from the general public.

Mr. Stein is, we believe, a Hungarian, who, to its great advantage, has joined the Indian Educational Service, and from his narrative we gather that he has an exceptional knowledge and command of many of the dialects in use in the north of India. At one place he expresses a deep regret that he does not know Chinese; but, however this may be, his command of clear, nervous, graceful, and expressive English leaves nothing to be desired, and the narrative from first to last is never wearisome or monotonous. For achieving success in the expedition which he undertook Mr. Stein had very remarkable and exceptional qualifications in addition to his command of the northern dialects. He had much experience of what Anglo-Indian officers so lovingly remember as "camp life," and so was accustomed to roughing it, and ready to adapt himself to any unexpected emergency. He understood the natives of the north thoroughly, sympathised with them, and fully appreciated their good qualities, although quite wideawake to their bad ones, and he had the gift of winning and retaining their confidence and esteem. Besides this he had been accustomed to deal with Orientals in the higher ranks of life, and his experience enabled him to assign the just and exact value

[1] *Sand-buried Ruins of Khotan*. By M. Aurel Stein. London: T. Fisher Unwin. 1903. Price 21s.

to be placed on forms and points of etiquette, the want of which so often places an European official in an unpleasant light, and entails on him a reputation for boorishness, or at least discourtesy, which in nine cases out of ten is quite undeserved. The friendly and courteous intercourse between Mr. Stein and the mandarins and officials, whom he was constantly meeting, could not fail to impress favourably officials who by birth and training are notoriously punctilious in the matter of politeness and forms, and it most undoubtedly tended to smooth his way and to facilitate the thorough completion of his task. To these qualifications Mr. Stein adds a very exceptional physique, great capacity for physical labour, a thorough knowledge of whatever had been previously known about Chinese Turkestan, an inexhaustible enthusiasm for the work, a sound sense of proportion and of his own limitations, and a kindly prudence for, and consideration of, the strength and weakness of his subordinates. Lastly, and descending to more prosaic qualifications, we must add that he was able to conduct the whole expedition, which lasted for a year, and achieve its remarkable results at the modest cost of Rs. 11,000, or less than £740; and when we observe that he succeeded in keeping his expenditure within the sanctioned estimate, we record a fact which rarely or ever occurs in such expeditions in India or elsewhere.

In the review already alluded to we gave a summary of Mr. Stein's route, which for facility of reference we may here repeat. Starting from Srinagar, in Cashmere, in the end of May 1900, he marched through Gilgit and Hunza over the Kilik Pass into Chinese territory on the Taghdumbash Pamir, where he began his plane-table survey and systematic triangulation by theodolite. He visited the head of the Ab-i-Panga valley, near the glaciers from which the Oxus issues. Thence he passed on to Tashkurghan, for which, as an historical site, he claims greater antiquity even than that implied by the notices of Sungyun and Hiuen-Tsiang. From here he proceeded with the survey of the Muztagh-Ata range, and on to Kashgar, where he made the final arrangements for his journey to Khotan, choosing the southern edge of the desert for his line of route, as "there was to be found clear evidence that all along we were following the same great thoroughfare by which, in earlier times, the trade from the Oxus region and the Far West passed to Khotan and to China." He reached Khotan in October, and spent nearly a month in completing the survey of the Kuen-luen range and the triangulation of the Khotan mountains. He was allowed to enter the Kohmari cave or grotto, identical with the Mount Gosringa of Hiuen-Tsiang, from which MM. Grenard and Dutreuil de Rhins had received certain birch-bark leaves of manuscript, of the genuineness of which Mr. Stein has doubts. Thence he proceeded to explore some of the old sites of buried cities referred to by Dr. Sven Hedin in his address to this Society in December 1897 (*vide* vol. xiv. page 30), and he confirms the opinion of M. Grenard that the modern Yotkan is the site of the ancient capital of Khotan. From here he made expeditions to Dandan-Uiliq, Niya, Imam Jafir Sadik, Endere, Karadong, Uzun-tati, Arka-Kuduk Tim, and Rawak, from each and all of which localities he

excavated or acquired by purchase the archæological remains which are now in the British Museum.

Mr. Stein's important contributions to geography are summed up by himself in a couple of sentences in his preface, which run thus: "A continuous system of surveys, by plane-table, astronomical observations and triangulation, was carried on during the whole of my travels in Chinese Turkestan. The results of these surveys, which in the mountains I was able to supplement by photogrammetric survey work of my own, and the direction and supervision of which claimed much of my time and attention, are now embodied in maps published by the Trigonometrical Branch of the Survey of India. From these the small scale map was prepared which, with the kind permission of the Royal Geographical Society, has been reproduced for the present volume." What mountaineering at the headquarters of the Yarung-Kash means may be gathered from the following extract from Mr. Stein's volume: "We had made our way for about a mile and a half onwards, when all further

Muztagh Peak, in Kuen-Luen Range.

progress was barred by a ravine descending from a great height and flanked by wholly unscaleable rocks. The view I had before me was wild in the extreme. I could now clearly make out the walls of frowning cliffs, which, broken only by almost equally precipitous shoots of rock and shingle, lined the foot of the great spurs falling off to the river. The passage left for the river seemed nowhere more than 200 feet wide, and at places considerably less. The volume of water reduced by the autumn now filled only one-half to three-fourths of this space. But the beds of huge boulders seen along the actual channel were not continuous, but alternately on the left and right bank. Where the river flowed with light green colour over boulders and ledges, we might hope to effect a crossing. But where it whirled round the foot of sheer cliffs, the water showed a colour of intense blue, and was manifestly far deeper. Yet it was clear that our only hope lay in being able to follow up the river-bed. To descend it was no easy matter from where we stood. But after marching back for half a mile we found a practicable slope and managed to scramble down to the edge of the water. When the yaks had been dragged down too, with much trouble, we began to make our way up

the ravine. A wall of impassable rock, with a stretch of deep water at its foot, forced us soon to search for a ford to the opposite side. This we found, and thanks to the yaks, which waded splendidly in the ice-cold water, undismayed by the rapid current, we managed to get safely across. The yak is a difficult animal to guide, even on the best ground; when in the water, any attempt to control its movements would be useless. So it was with a feeling of relief that I noticed the instinctive care with which our yaks made their way from one convenient boulder to the other. The limpid water made it possible for them to see their way as much as to feel it.

"On the left bank we had scarcely advanced a few hundred yards over jumbled masses of rock that had been swept down from the slopes above, when we were stopped again by a precipitous rock-face, washed at its foot by the ominous blue water. To cross over to the opposite bank, where a stretch of boulder-strewn ground might have allowed an advance, was quite impossible. The yak we drove into the water to test its depth was soon obliged to swim, and had we attempted the passage we should have had to follow its example. In order to effect a crossing here with the needful baggage a raft or boat was manifestly indispensable.

"The only chance of progress left was to take to the crags above us, and to trust that further on a descent might be found again to a practicable portion of the river-bed. After a difficult climb of some 500 feet I managed to bring myself and my men safely to a narrow flat ledge, but the yaks had to be left below. We followed the ledge for some hundreds of yards until it ended at the flank of a ravine, that would have defied any cragsman. A careful search for a point where we might descend again to the river was in vain. The steep, shingly slope terminated everywhere in cliffs that offered no foothold. Baffled in these endeavours, I climbed up the precipitous hillside above the ledge that had brought us so far, in the hope of turning the ravine. But after an ascent of about 1000 feet I convinced myself that the ground beyond was one over which I could never hope to move either yaks or men with loads."

Mr. Stein, following the example of Dr. Sven Hedin, made several fruitless attempts to scale the giant Muztagh-Ata (24,231 feet), and we quote his own description of the final attempt. The party, starting at 3.30 A.M. on the 19th July, shortly before midday reached an altitude of nearly 19,000 feet. "After another short snow-squall had passed we resumed our climb, but the Sub-Surveyor and Ajab Khan began to complain of headache and general lassitude. Bichlorate of potash tabloids, with which, after Dr. Bellew's advice, I had provided myself, proved of little avail, and by 1.30 P.M. Ram Singh had to remain behind. The wind had by this time driven away all clouds that hung over the ranges west and north, and he was thus able to check his plane-table work by rays to a number of distant peaks previously sighted or triangulated. Twenty minutes later Ajab Khan, skilled mountaineer as he is, fell out and received permission to descend. There remained now Wali Mahommed and Ghun, my two Hunza levies, and they without a word of complaint steadily plodded on with me. The snow became still deeper, and the mist

that settled on the peaks above us showed clearly that a further ascent would offer no chance of a close survey of the summits. A change in the weather seemed almost to threaten, and after due deliberation I fixed upon the buttress of the ridge just before me as the final object of the climb. By 2.30 P.M. I had reached its top, and settled down by the side of the precipitous rock wall descending to the glacier. In the piercing wind it was not easy to boil the water for the hypsometer. By scooping a hole in the snow, however, sufficient shelter was at last secured, and repeated careful readings of the thermometer gave a mean of 177·8° Fahr. as the boiling point. Taking into calculation the temperature of the air, which was 33° Fahr., this corresponds to an elevation of almost exactly 20,000 feet. Our bodily condition would have allowed a further climb, though I as well as my Hunza followers felt the effect of our six hours' ascent through the snow. But neither the state of the weather nor the remaining daylight justified the hope that we could reach the end of the

Icy Range with Peaks above Kongur-Debe and Koksel Glaciers.

spur reconnoitred on the previous day. I accordingly decided to descend, and to let a fresh attempt at reaching that point depend on the chance of the weather improving on the next day." The weather which ensued forbade all hope of a successful ascent, and the attempt to scale Muztagh-Ata had to be abandoned. The peaks above the glaciers of Kongur-debe and Koksel are, according to Mr. Stein's triangulation, respectively 23,600 and 23,470 feet in height.

We trust we are not doing an injustice to Mr. Stein when we suspect that, energetic, skilful, and successful as he was as a mountaineer and surveyor, his real enjoyment lay more in the work of excavation and acquiring antiquarian and archæological treasures, and of these he has secured for us a store with which only the famous finds in Babylonia and Egypt can be compared. The light they shed on the civilisation and history of Chinese Turkestan is for the time veiled, until they have been classified, compared, and studied as they deserve. The locality from which they were rescued lies to the east and north of Khotan, and is a

part of the great Taklamakan desert, with which the readers of Dr. Sven Hedin are familiar. The sites which were excavated are near the Keriya, Niya, and Endere rivers, which flow roughly from south to north. These rivers, owing to the shifting sands of the desert, continually change their course, with the result that the population have to abandon their villages and move elsewhere where the possibility of irrigation gives a prospect of successful cultivation. In process of time the desert sands overwhelm the deserted houses, temples, etc., and unless disturbed by the ruthless hands of "treasure-finders," many of the contents of these buildings are revealed to the excavator of to-day in a fair state of preservation. The appearance of these deserted sites both before and after excavation is very successfully brought before us by the excellent photographs and

Portion of Ancient Dwelling-House, before excavation.

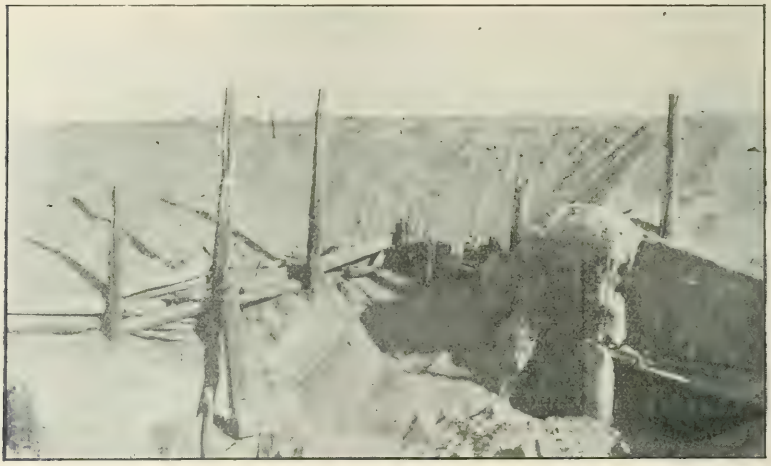
illustrations, which form one of the many attractions of this book. The antiquarian remains found consist of pottery, images, coins, seals, statues, frescoes, inscriptions, painted tablets, manuscripts in Sanscrit, Brahmi, and Chinese, wooden tablets in Kharoshti, pens, household furniture, pulse, wheat, rice, oats, currants, etc., of which, for obvious reasons, the coins, seals, inscriptions, tablets, and manuscripts are the most valuable in the eyes of the historian, antiquarian, and ethnographer. The inscriptions, tablets, and manuscripts are in the hands of the experts of the British Museum, and the results of their labours will naturally not be available to the public for some time. As to the coins, of which about one hundred were secured, none of them gold, they were found in many localities. At Yotkan 'the copper coins, which are found plentifully, range from the bilingual pieces of the indigenous rulers, showing Chinese characters as well as early Indian legends in Kharoshti, struck about the com-

mencement of our era, to the square-holed issues of the Tang dynasty (618-907 A.D.)." The Chinese copper coins found at Dandan-Uiliq bear the date of the Kaiyuen period (A.D. 713-741); those found at Niya and at Karadong belong to the issues of the second Han dynasty (A.D. 25-220). At Rawak the coins found bore Wu-tchu symbols and belonged to issues of the Han dynasty. When all these coins have been deciphered, it is more than probable that with their help some important dates and facts in the history of Chinese Turkestan may be settled.

With regard to the seals, it is well to let Mr. Stein speak for himself. "From an historical point of view they claim exceptional interest, for they have furnished convincing evidence of the way in which the influence of classical Western art asserted itself even in distant Khotan. It was a delightful surprise when, on cleaning the first intact seal-impression that turned up, I recognised in it the figure of Pallas Athene, with ægis and thunderbolt, treated in an archaic fashion. This particular seal was found to recur frequently, and probably belonged to an official who was directly connected with the administration of the ancient settlement. Another and larger seal shows a well-modelled naked figure of pure classical outline, perhaps a seated Eros. Another Athene, a standing Eros, and probably Hercules, are also to be found among the Greek deities represented. On the other seals, again, there appear portrait heads of men and women showing classical modelling, though barbarian features, etc. It is impossible to make sure which of these seals were actually engraved in Khotan territory, and which were imported from the West or other parts of Asia reached by classical art. But though we have yet to learn the exact functions or place of residence of those who once used the seals, there can be no reasonable doubt that the documents bearing their impressions originated in the vicinity of the ancient site or at least within the borders of the Khotan kingdom. As the date, too, of the documents can, as we shall see, be fixed with fair accuracy, these seal-impressions are to us far more valuable than if chance had preserved the original seals. The vista thus opened out to us is one of far-reaching historical interest. We already knew that classical art had established itself in Bactria and on the north-west frontier of India. But there was little to prepare us for such tangible proofs of the fact that it had penetrated so much further to the east, halfway between Western Europe and Peking."

Important as the coins and seal-impressions are as evidence of historical facts and local conditions, it is from the inscriptions, tablets, and manuscripts that we must expect trustworthy and accurate information of the details of the civilisation of the period to which they refer. Under these circumstances we can cordially concur with Mr. Stein when in his introduction he says: "It is fortunate indeed that, at the very sites which proved richest in relics of material culture, the finds of ancient manuscripts and documents were also unexpectedly ample and varied. The Sanskrit manuscripts excavated at Dandan-Uiliq acquaint us with that class of canonical Buddhist literature which we may assume to have been most cherished in the monastic establishments of ancient Khotan. The series of Chinese historical documents discovered in ruins of the

same site is of particular historical interest. The exact dates recorded in them (781-790 A.D.), in combination with other evidence, clearly indicate the close of the eighth century as the time when the settlement was deserted, while their contents throw curious side-lights on the economical and political conditions of the territory immediately before Chinese suzerain power finally abandoned these regions to Tibetan invasion. Sanskrit manuscripts and records in Chinese mark foreign imports in the culture of Khotan. All the more interest attaches to the numerous documents and fragmentary texts from the same site which show an otherwise unknown language, manifestly non-Sanskritic yet written in Indian Brahmin characters; for it appears very probable that in them we have records of the tongue actually spoken at that period by the indigenous population of Khotan.



Room of Monastic Dwelling, Dandan-Uiliq, where ancient manuscripts were found.

"We see Sanskrit, Chinese, and the same non-Sanskritic language similarly represented among the literary finds from the ruined temple of Endere, in the extreme east of the territory explored. But here in addition there appears Tibetan, as if to remind us of the prominent part which Tibet too has played in the history of Central Asia. . . .

"But much older and of far greater importance than any of these finds are the hundreds of Kharoshti documents on wood and leather brought to light from the ruined houses and the rubbish heaps of the ancient settlement discovered beyond the point where the Niya river now loses itself in the desert. Their peculiar writing material (so much older than the paper of any other literary finds), their early Indian script and language, and the surprisingly perfect state of preservation of many among them would alone have sufficed to invest these documents with special interest. But their exceptional historical value is derived from the fact that they prove to contain records written as early as the

third century of our era, and dealing with a wide range of matters of administration and private life." A number of these Kharoshti documents have already been deciphered, and at the head of some there appears an introductory formula, the translation of which is, "His Highness the Maharaja orders in writing." A cursory inspection suggests that the documents are "reports and orders to local officials on matters of administration and police, complaints, summonses, safe-conducts," records of payments or requisitions, agreements, bonds, accounts, lists of labourers, and the like. In passing we may note as remarkable that "though the use of paper is attested in Chinese Turkestan from at least the fourth century A.D. onwards, yet (Mr. Stein says) I failed to discover even the smallest scrap of paper among all the ruined houses and ancient rubbish heaps."

In the foregoing remarks we have dwelt mainly on the geographical and antiquarian interest of this book, but we desire to remind our readers again that this is a popular description of a most interesting expedition, and to assure them that Mr. Stein has enlivened his narrative with many amusing anecdotes illustrating the life and conditions of those among whom he travelled. He has also the eye of an artist and the pen of a ready writer in depicting the marvellous scenery through which he passed, and he has embellished his work with more than a hundred beautiful photographs, which materially increase the enjoyment of the reader. By the courtesy of the publisher, we are able to reproduce some of these illustrations.

SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

THE Secretary of the Scottish National Antarctic Expedition has sent us the following lists of subscribers—in money and in kind—to the Expedition. Owing to the number of firms and others who contributed, the expedition was largely supplied with food, clothing, books, maps, instruments, and so on. This occasion may well be taken to acknowledge the magnificent liberality of Mr. James Coats, jun., of Paisley, and his brother, Major Andrew Coats. It is not too much to say that but for their generosity the Scottish Antarctic Expedition would never have started.

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It is interesting to note that of the total of about £28,400, some £26,900 has been subscribed by members of the Scottish Geographical Society. A further sum of £12,000 is urgently required to carry on the work until the ship comes home six months hence.

GEOGRAPHICAL NOTES.

EUROPE.

Future of the Channel Islands.—M. Paul Bourge gives an interesting account of the Channel Islands from the French standpoint. He points out that while the population of Guernsey and Alderney is increasing, that of Jersey and Sark is decreasing. Jersey had 57,155 inhabitants in 1851, as compared with 52,584 in 1901. Since the middle of the nineteenth century, according to M. Bourge, there has been continued effort to Anglicise the islands, and to drive out the French language. While at Guernsey the French colony is small and French tourists rare, in Jersey French tourists (*i.e.* tourists entering from French ports) are half as numerous as those coming from English ports, and the French colony numbers 6011 persons. The port of St. Helier is progressively diminishing in importance year by year. As is well known, the island depends largely upon the potato, which is the main crop of the island. But of recent years the potato has been cultivated more and more in Brittany, and the French potatoes threaten to drive the Channel Islands products from their market.—*Bulletin de la Société de Géographie Commerciale de Paris.*

ASIA.

Hong-kong.—Sir Henry Blake's report on Hong-kong for the past year gives the revenue of the colony as 4,329,712 dollars, exclusive of land sales, which reached 571,361 dollars, all the main heads of revenue showing an increase over the estimates. But the total expenditure was 5,909,548 dollars, and was much beyond the estimate, mainly because of heavy outlay in connection with the plague. At the end of the year, however, the assets of the colony exceeded the liabilities by a substantial sum. Out of a total tonnage of $6\frac{1}{4}$ millions visiting the port, just on 3 millions were under the British flag, German shipping coming next with 1,360,524, and Japanese third with 865,400 tons. These figures refer only to steamers. Local cotton spinners had a successful year owing to the fall in exchange checking the imports from India; the governor considers that "under normal conditions the progress of this industry may now reasonably be considered as assured," although there is always the risk of the plague driving labour from the colony for a time. As to the important sugar industry, Sir Henry Blake says it had many adverse conditions to meet, chief amongst which were the low prices at which the bounty-fed beet sugars from Europe were placed on the market, and the preferential treatment of refineries in Japan, which was formerly an important outlet for Hong-kong sugar. The population at the beginning of the year was 311,824, including 18,524 non-Chinese, but excluding the military and naval forces. That of the New Territory was about 110,000. Progress in the latter has been gradual and peaceful, and if it were not for the occasional inroads of disorderly characters from the Chinese side of the frontier there would be but little to record in the way of robbery or outrage. The demarcation of the whole of the New Territory, with certain exceptions, was finished during the year. The construction of an excellent road from Kan-lung to Tai-po, a distance of about 18 miles, was practically completed. The police system is also complete, and nearly every station is connected with the city by telephone. The settlement of land claims has been steadily progressing. The area of the New Territory is about 370 square miles, of which the cultivated area is about 45,000 acres, or 60 square miles. At present the expenditure on it is considerably in excess of the revenue;

but, judging from the present rate of progress and the prospects for the future, it may be expected that they will be equal within seven or eight years. In conclusion the governor says: "In spite of the depression, caused especially in import trade by fluctuations in the silver market and other more remote causes, the prosperity of the colony has continued to expand during the past year. Statistics show that in spite of the heavy drain upon the resources of the colony caused directly and indirectly by the annual recurrence of plague, the financial position of the colony is sound and gives no cause for uneasiness for the future. At the same time it is well to remember that the assets of this colony are practically the goodwill of its commerce, and it is only by a continuance of its sea-borne trade—which fortunately as yet shows no sign of declining—that the colony can expect to remain in its present prosperous condition."

Indian Census Returns.—The census of Calcutta city for 1901, published during the current year, shows that the population, including Howrah on the right bank of the Hoogly, is 1,107,000, greater than that of any city in Europe, except London, Paris, Berlin, and, possibly, Constantinople, and exceeded in America by three cities only, New York, Chicago, and Philadelphia. An advance of 24 per cent. has been marked since last census, and the recent developments of the coal and iron industries point to a still more rapid future increase. Males outnumber females in the proportion of 19 to 10, a fact explained by the large number of immigrants, who come for work and leave their women at home. Hindus formed 65, Mohammedans 30, Christians 4, and Europeans 3 per cent. of the population. A more general interest attaches to the report on the census of the Punjab and North West Frontier Province; and Mr. Rose has made the most of the wide field which the Province of the Five Rivers offers to the ethnologist. Now that the frontier districts have been made by Lord Curzon into a separate Administration, there remain nearly 25 out of 27 millions under the Government of the Punjab, the density of the population of which varies from 54 to 634 with an average of 208 per square mile. The increase since 1891 is 14·6 per cent. in native States, and 18·6 per cent. in British territory. Among the causes which prevent the population from exceeding the limit of subsistence are mentioned the extension of canal cultivation and the migratory spirit of the population, which emigrates freely to other parts of India, to Hong-kong, the Straits, China, and South Africa. Only 11 per cent. of the people dwell in towns, and in town and country alike the Mohammedans have increased far more rapidly (9·5) than the Hindus (4·1), a fact of which no very satisfactory explanation is forthcoming. In the Punjab province, as in Calcutta city, women are in a minority of 852 to 1000, which is about the proportion existing in Australia, but lower than the Asian average of 958, and far below the European average of 1024. The superintendent ascribes the difference in a great measure to the social system, which forbids a woman of a particular social group to marry a man of a group lower than her own, and compels her to enter a group of equal or superior rank. This custom led in former days to wholesale female infanticide, and at the present time results in greater mortality among females, though not to an extent sufficient to explain so large a discrepancy, which the leading Indian journals, such as the *Pioneer* and *Times of India*, do not hesitate to ascribe to the existence of female infanticide in one form or another. Among the Sikhs the proportion of women, 766 per 1000, is even lower than the local average. Mr. Rose describes Hinduism as a social system, the artificial restraints placed by which upon marriage lead to a scarcity of women, rather than as a religion. "Hinduism" in fact is, "what the Hindus, or the major portion of them, in a Hindu community do"; and the Sikhs, whose creed rejects idolatry,

caste, and plurality of deities, rarely act up to their belief, so that the line between Sikhs and Hindus is vague and undetermined. Native Christians have nearly doubled since last census, and now number 38,513 souls. Mr. Rose says the everyday morality of the masses is not high, but they have their standards of right and wrong, altruism is concentrated upon the caste, tribe, and family, and the latter tie demands far greater sacrifices from the individual than in the west. The statistics of literacy show that among Christians less than half are educated, while among Hindus and Mohammedans the average is much lower, particularly in native States.

The reports of the native States comprising the Central India agency and of Haidarabad exhibit many specially interesting features, but do not pretend to such accuracy as is attained in the case of British provinces. The former deals with an area of upwards of 78,000 square miles, including the important States of Gwalior, Indore, and Bhopal, and a population of 8,000,000, or 16·4 per cent. less than in 1891—practically the whole of the area concerned being, it should be remembered, under the immediate administration of native rulers, much of it having suffered very severely during the recent famine, and 88 per cent. of the people residing in villages and following for the most part agricultural pursuits. Of the population nearly all are Hindus and Animists. The Brahminical prohibition of widow remarriage is described by Captain Luard as a comparatively recent institution, carrying no weight among low castes until they aspire to a higher social position. The adoption of this prohibition and the introduction of infant marriage are the first steps towards a social rise.

The census of the native State of Haidarabad, area 82,698 square miles, population 11,141,142, was carried out by an officer of the Nizam's Government, Mirza Mehdi Khan ; and the result is a decrease of 3·43 per cent. compared with the figures of 1891, due, directly or indirectly, to the famine of 1899-1900. Hindus are over 88 per cent., as against a little over 10 per cent., who, like the ruling family, are Mohammedans. The latter, like the Christians in a less degree, are slowly gaining in numbers at the expense of the Hindus. The superintendent believes the disparity between the sexes, 964 females, to 1000 males, to be due to frequent concealment of the existence of women, and not to their existing in smaller numbers. The educational statistics show that 3 per cent. are literate, compared with 4·62 in all India.

AFRICA.

Explorations in Tripoli.—M. de Mathuisieulx has recently returned to Paris from a journey of exploration in Tripoli. In 1901 the explorer obtained permission, rarely given by the Turkish authorities, to travel through that little-known country in order to collect information on its natural products and geological structure as well as upon its ancient monuments and racial types. M. de Mathuisieulx made an interesting report on the subject to the Minister of Public Instruction, and it was to complete his observations that he again visited Tripoli in the spring of the present year. He first made a careful study of the ruins at Sabratha, about 60 miles from Tripoli, and a considerable port under the Phœnicians. From Sabratha M. de Mathuisieulx travelled south to the Djebel Mountain, where he was able to establish the fact that the celebrated Roman road from Gabes to Lebda passed not by Ghadames, as has been for long supposed, but over an elevated plateau in the district. The traveller noted that in this neighbourhood the ruins of various temples and mausoleums are disappearing, as the inhabitants use the stones to build their houses. At Gherza, 70 miles to the south of Misda, the mission visited other ruins belonging to the Byzantine

period. Copies were taken of numerous inscriptions and bas-reliefs of considerable archæological interest. At Orfela and in the valley of Nefed mausoleums of a style of architecture peculiar to this part of Africa were discovered. They were of ancient date and displayed an unusual wealth of detail. In this case the monuments had been respected by the inhabitants, who were, indeed, of too nomadic a character to have recourse to building material of such a nature. In addition to his archæological researches, M. de Mathuisieulx made an ethnographical study of the native negro.

The Lake Chad Boundary Commission.—Reuter's Agency has received intelligence regarding the progress of the Anglo-French Boundary Commission, which is now delimitating the frontier between the Niger and Lake Chad. On May 11 the Commission had completed about one-third of the entire frontier, and was at Illela, 100 miles north of Sokoto city. It was hoped that the delimitation, as far as the eastern end of the arc of 100 miles drawn round Sokoto city, would be finished by the middle of June. From Illela it was intended to strike south to Sokoto city for the purpose of fixing its position astronomically, and then the Commission, which has been working in sections, was to reassemble and proceed along the fourteenth parallel for a distance of about 800 miles to Barua. The difficulties in fixing the boundary round the arc have been great, as the country is practically desert, with a temperature as high as 113 in the shade. As the boundary east of the arc follows a straight line, the remainder of the work is expected to be much easier. The commissioners expected to reach Lake Chad by August.

AMERICA.

Surveying the Canyons of Colorado.—A recent number of *Science* gives an interesting account of some difficult survey work successfully carried out in Western Colorado. In connection with a project for constructing a tunnel six miles in length in order to convey water into the Uncompahgre Valley, it became necessary to make a survey of about 1500 feet of the bottom of the Grand Canyon of the Gunnison River. At the point in question the canyon is approximately 2000 feet in depth, the walls being sheer precipices. The water flows very swiftly over huge boulders and through narrow gorges, and it is impossible to use boats, or traverse the canyon longitudinally in any way. It was therefore necessary to descend into the canyon over cliffs and through narrow fissures in four different places. The topography of the talus slope for about 600 feet on the south side of the river was taken first by descending through a narrow fissure which, being of softer materials than the granite cliffs of which the walls are generally composed, had in the process of time eroded, so that it was possible for a party to descend. Subsequently, by means of a detour of approximately 150 miles, the party came down a similar fissure on the opposite side of the river and obtained the topography of that side for about an equal distance. About 12,000 feet further up-stream they were able to descend again to another short talus slope, although the descent was extremely perilous, it being necessary for the party at times to descend over steep cliffs for several hundred feet by means of ropes. On the opposite side was another small talus slope, which was reached by a similar descent, after the return of the party to the south side. There was one other talus slope, between the extreme tracts already mentioned, which it was impossible for the party to reach with instruments, but one man descended this slope also by means of ropes, in order that he might set signals for triangulation.

Survey of Alaska.—According to *Science*, a special division of the U.S.A.

Geological Survey has been created to include the survey of mineral resources of Alaska. For some years past extensive surveys and investigations have been carried on in Alaska, and have proved of great practical use to prospectors and miners. There are now seven survey parties in the field, of which two are mapping and investigating the placers of the Nome region, two the gold deposits of the Yukon, while the sixth and seventh are making reconnaissances, the first of the petroleum fields of Controller Bay and Cook Inlet, and the second of the vein deposits of the Juneau and adjacent districts.

The Mongoose in Barbados.—The history of the mongoose in Barbados affords an interesting example of the danger of interfering rashly with the balance of nature. About a quarter of a century ago the sugar crop of the island suffered severely from the depredation of rats, and about 1878 the mongoose was introduced in the hope of destroying the rodents. For a time the experiment proved highly successful, but as the rats diminished in number their opponents, who had meantime multiplied greatly, sought other sources of food supply. Thus they eliminated much of the indigenous fauna, notably the lizards. The diminution of the lizards led to the increase of boring caterpillars, which attack the sugar-canes, and prepare the way for the entrance of the spores of destructive fungi. In consequence the governor of the island has been petitioned to authorise the destruction of the mongooses.

Summit of Mt. Pelée.—In the *Popular Science Monthly* for September, there is an interesting photograph of the summit of Mt. Pelée, taken by Prof. Angelo Heilprin on June 13, 1903. The great point of interest is a gigantic plug of lava which has been thrust up from the summit of the new cone of the volcano. This cone rises from the old crater-basin to the height of more than 1600 feet, and is dominated by an ascending obelisk of lava, which when first observed was about 1000 feet in height. It is about 300 to 350 feet thick at its base, and ends in a needle summit. The obelisk has lost about 180 feet since it was first observed, but still adds 800 to 900 feet to the mountain. Its formation is apparently due to the fact that the lava solidified so rapidly that it was unable to flow away, and the mass was pushed upwards by accretions from below.

AUSTRALASIA.

Australasian Association for the Advancement of Science.—As was noted in a previous issue (p. 381), this association is to meet at Dunedin next January. It is now announced that the Colonial Government is rendering material assistance to the association. A sum of £500 will be placed on the estimates of the present year towards the expenses of the meeting, the Government printer will be instructed to do all printing required by the association free of cost, railway passes will be issued to visiting members, and it is also announced that any assistance that it may be in the power of the permanent departments of the Government service to render to the association, will be readily afforded on application being made.

POLAR.

Expedition to North Pacific Ocean.—It is announced that a scientific expedition will leave Stockholm next April by railway for Port Arthur by way of Siberia, with the object of exploring the northern parts of the Pacific. At Port Arthur the expedition will embark on a ship under the leadership of M. Kolthoff, who will be accompanied by five or six other Swedish naturalists.

Arctic Geology.—In connection with Dr. Schei's Preliminary Account of the geological results obtained by the second expedition of the *Fram* which appeared in our July number, a brief note in *Nature* by Prof. Bonney on the general bearing of these results is of interest. Prof. Bonney points out that these results, in combination with those obtained by previous investigators, prove that in the region of Ellesmere Island, in the newly discovered Heiberg Land, and in North Devon, a plateau-like region of Archæan rocks existed, and, perhaps before the beginning of the Palæozoic, was submerged and buried beneath Cambrian, Ordovician, and Silurian deposits, perhaps in orderly succession. These beds were followed by marine Devonian and Carboniferous beds, possibly without interruption. After a break with considerable physical disturbances, some beds of Triassic age were deposited which are succeeded by Jurassic. Another great break is only interrupted by isolated Tertiary deposits, and with the exception of a considerable late or post-Glacial submergence, terrestrial conditions may have remained generally persistent since.

Arctic Expeditions.—It is announced that Commander Peary has obtained three years' leave from the Navy Department, and hopes to start once more for the north at the beginning of July, 1904. He will employ a new steamer, and proposes to establish a permanent base at Cape Sabine, and starting from there take up winter quarters in Grant Land, and then make a start for the Pole in the following February (1905). The expedition will consist of an advance party with lightly-loaded dog-sledges, and a larger, more fully equipped supporting party.

It is further announced that Captain Bernier's arrangements have now been completed, and that he also will start for the north next year. Captain Drake, whose name has not previously been mentioned in connection with Polar exploration, is stated to be planning an expedition whose object is the Pole.

GENERAL.

The International Study of the Sea.—The council of the Marine Biological Association, in the report for 1902-1903 presented to the annual general meeting on June 24, state that the work of the association has been considerably augmented in consequence of the fact that a commission has been accepted from H.M. Government to carry out in the southern British area the programme of scientific fishery investigation adopted by the International Conference which met at Christiania in 1901. The work in connection with these investigations is being carried out in the southern part of the North Sea and in the English Channel. In connection with the North Sea work, a laboratory has been fitted out at Lowestoft, and the steam trawler *Huxley* has been hired. Some difficulty being experienced in obtaining a suitable vessel with the funds provided by Government, Mr. G. P. Bidder, one of the members of the council, himself purchased the *Huxley* from her former owners, and let her upon favourable terms to the association. Accommodation for the naturalists has been fitted up in the old fish-hold of the trawler, and a small laboratory has been built on deck.

The English portion of the international scheme of hydrographic and plankton observations, the execution of which has been assigned to the association, is to be carried out in the western half of the English Channel. These investigations have for their object the study of the seasonal changes which take place in the physical and biological conditions prevailing over the entire region covered by the international programme, though more particularly directed to a study of the waters entering the North Sea from different directions. They are designed to determine (1) the origin, history, and physical and biological characters of the

water found in each locality at different seasons of the year and at corresponding seasons in different years, changes in which must necessarily have a profound influence upon the distribution and abundance of the fish life in the sea; and (2) the variations which take place in the floating and swimming organisms (plankton) which constitute the fundamental food supply of the sea.

The investigation is being carried out (1) by means of a series of quarterly cruises made simultaneously over the whole area by the vessels of the participating countries, as a result of which a thorough knowledge, based upon the most accurate available methods, is obtained of the conditions prevailing at all depths at certain fixed stations, together with a less detailed knowledge at intermediate points; and (2) by observations, more especially of the surface conditions, at as many points as possible during the time intervening between the seasonal cruises. Complete series of observations at twenty stations in the English Channel were obtained during the first fortnights of February and May.

Irrigation Works.—In *Nature* for August 27 there appear some interesting notes on irrigation works in various parts of the globe. The remarks on irrigation in India are chiefly taken from an article by M. Chailley Bert in the *Revue générale des Sciences*. This writer, after spending considerable time in inspecting the various irrigation works, expresses great admiration for the system, the methods pursued, and the results obtained. Irrigation in India is rendered necessary by the terrible famines which periodically visit a portion of this vast territory, in every instance caused by deficient rainfall, which sometimes lasts for two or three consecutive years. Further, the peasants inhabiting these districts are utterly improvident; population goes on increasing at an enormous rate, and when famine comes untold misery ensues, the people being decimated by starvation and death. M. Chailley Bert gives a vivid description of the irrigation works undertaken for the relief of the inhabitants in the great famine of 1901 in the Presidency of Bombay. Here five camps were established where provision was made for 10,000 people who were engaged in the construction of a reservoir. To this camp came a mass of people of all ages and conditions—old men, women, and children, in addition to the actual work people, and to deal with this multitude an admirable system of organisation was set on foot. The writer also points out that irrigation, besides providing a means of meeting the sterility due to the absence of rain, adds very greatly to the fertility of the land. It also permits the cultivation of the more valuable crops, such as rice, wheat, sugar-cane, and indigo, and it leads to other works which assist in the mitigation of famines, such as roads and railways for the conveyance of the produce of the irrigated lands. The Indian Government has already expended upwards of 23 millions sterling on irrigation works, providing water for 13 millions of acres at an average cost of 35s. an acre.

At the meeting of the South African Science Association held in May last, Mr. Westhofen read a paper in which he stated that, owing to the insufficiency and uncertainty in the distribution of the rainfall, it was absolutely necessary that irrigation should be resorted to if South Africa is ever to be made a self-supporting country. Thousands of square miles of the most fertile land are lying waste owing to the want of this most essential adjunct to agriculture, and meantime food to the value of 2½ millions of pounds is being imported through Cape Town.

In the report issued by the New Mexico College of Agriculture for April, an account is given of the experiments carried out for pumping water for irrigation from wells. Irrigation is rendered necessary in New Mexico by the smallness of

the rainfall, and experiments have therefore been undertaken with a view to demonstrate the practicability of providing a supply of water from the underflow. There are found to be two methods of thus obtaining water. One is by sinking a well down to the water-level, and then forcing perforated pipes to some depth below this, while the other is by driving tubes down from the surface some distance into the water-bearing surface.

Fish-eating and Leprosy.—In connection with the note which has already appeared in our pages on the relation between fish-eating and leprosy (p. 325), it is of interest to note a further communication by Mr. Jonathan Hutchinson to the *Times*, pointing out the high percentage of lepers among the Catholic white population of Colombia. It was in Colombia that some of the earliest Spanish settlements were made, and it was here according to tradition that the first cases of leprosy in the American continent occurred. There are stated to be 27,000 lepers in Colombia, out of a total population of 4,000,000; in other words, leprosy is nearly twelve times as prevalent in Colombia as in India, and it affects the white members of the community more markedly than the coloured. Mr. Hutchinson regards this as a very significant fact from his point of view, for the reverse is the case in other parts of the world, and he considers that it must be taken in combination with the fact that the creed of the white inhabitants enjoins compulsory fish-eating in districts where fish is often very difficult to obtain.

Mosquitoes and Tropical Diseases.—A large mass of material is now being accumulated tending to show the great importance of mosquitoes as carriers of infective diseases, and the value of anti-mosquito campaigns in lowering the death-rate in many tropical regions by diminishing the prevalence of such diseases. Thus the Commission sent by the U.S. Marine Hospital Service to Vera Cruz has proved (according to *Science*) that the cause of yellow fever is an animal parasite, that it is communicated only by the bite of mosquitoes, and that there is only one mosquito, *Stegomyia fasciata*, which can serve as the host of the parasite. In Havana yellow fever has been eradicated by means of energetic measures directed against mosquitoes, when other means had completely failed.

In the "Report of the Malaria Expedition to the Gambia, 1902, of the Liverpool School of Tropical Medicine and Medical Parasitology," it is pointed out that Europeans themselves are largely to blame for the prevalence of malaria in the colony, in that their compounds afford an enormous number of artificial breeding-places for the mosquitoes in the shape of barrels, tubs, wells, tin cans, and so forth. The Report points out that Bathurst is specially well situated for a campaign against mosquitoes, and this has been begun by the Government.

A note in *Nature* directs attention to an explanation recently offered of the fact—hitherto inexplicable—that localities exist in which the physical conditions appear to favour the development of malaria, and susceptible species of Anopheles also occur, but yet malaria is absent. In some cases these areas exist in immediate proximity to active foci of the disease, but the mosquitoes of the area appear to be insusceptible. The explanation now offered is as follows:—Dr. Schoo finds that it is extremely difficult to infect mosquitoes with the malarial parasite so long as they are fed on acid fruits, while they are easily infected when acid fruit is withheld. This is confirmed by an observation made by Prof. Celli, who states that one of the Italian immune areas is remarkable for an enormous development of the cultivation of the tomato, which is rich in vegetable acid and very attractive to mosquitoes. If further observation prove these conclusions to be correct, they arm Preventive Medicine with one more weapon in the conflict with malaria (cf. also this *Magazine*, p. 385).

As to the campaign against malaria, the Liverpool School of Tropical Medicine has received a report from the Suez Canal Company on the subject of the result of Major Ross's recommendations for the improvement of the sanitary conditions at Ismailia, with special reference to the campaign against mosquitoes. Major Ross, accompanied by Sir William MacGregor, went out to Ismailia in the autumn of last year to study the question of the prevalence there of malaria. Major Ross was sent out by the Liverpool School of Tropical Medicine, at the special request of Prince d'Arenberg. The report begins by referring to a statement made quite recently by the principal medical officer of the Sudan to Major Ross that the sanitary state of Ismailia is now much improved. The secretary-general proceeds to say that since the visit of the expedition of the school to Ismailia in September last several important drainage works have been undertaken, including the filling up of water puddles, and that a special service had been created for the purpose of supervising this work, specially charged with the duty of pouring oil on the pools and disused wells, doing away with marshes, puddles, etc., existing in and near the residential quarters of Ismailia. On the other hand, prophylactic measures, such as gratuitous distribution of quinine, "liqueur de Fowler," have been continued without interruption since April 1902. In December the number of cases of fever had decreased in a most marked manner compared with preceding months and the corresponding month in the previous year. The secretary-general states that this diminution in fever has been maintained up to the date of writing—namely, July 2 in the present year. Thanks to systematic oiling of pools and to the unceasing watch kept over all likely places where larvæ can be hatched, the ordinary mosquitoes of the genus *Culex* and *Stegomyia* have been annihilated almost absolutely, and even in the worst period of the hot season it has been found possible to dispense with the use of mosquito nets. The secretary-general ends with a testimony to the value of the work of the expedition, and says they have every hope that the assistance rendered by Major Ross will result in the complete abolition of malaria from the town of Ismailia.

Measurements of Gravity.—At the conclusion of the recent Geodetic Congress at Amsterdam a resolution was passed requesting the various nations to carry out extensive measurements of gravity from the Atlantic towards the east through the lowlands of Europe and Asia, as well as in the plateau round Tibet. A clear conception of the variations of weight and of the distribution of bulk in the crust of the earth would be gained thereby in connection with astronomical determinations of longitude and latitude.

Magnetic Disturbances on Alaskan Coast.—Professor S. J. Barnett of Stamford University, who has been investigating certain magnetic disturbances on the Alaskan coast which render navigation difficult, has found an abundance of magnetic rock in the vicinity of Skagway and Douglas Island, which almost makes a local magnetic pole at that point.—*Times.*

Cheap Ordnance Survey Maps for Teaching Purposes.—We have received the following communication from Dr. A. J. Herbertson, Honorary Secretary of the Geographical Association: "May I through your columns call the attention of your readers to an important concession which has recently been made to schools by the Board of Agriculture? Most teachers know how necessary Ordnance Survey maps are for sound class teaching in local geography, but the price has hitherto been prohibitive. In response to memorials from various sources the Board of Agriculture has now issued instructions that special editions of the one-

inch sheets of the size of those of the English survey be supplied to educational authorities at the following prices: 200 copies, £1, 5s.; 500 copies, £2; 1000 copies, £3; 5000 copies, £12. For larger numbers the estimated price would be £2 per 1000 copies. The only stipulation made is that on no account are the maps to be sold. It is universally agreed that all sound geographical teaching must begin in a study of the home region, and it is therefore to be hoped that most teachers will avail themselves of the facilities so generously granted, either individually or by making application through the local education authority. Further information may be obtained through the Geographical Association."

Dr. Herbertson also informs us that the Geographical Association proposes to hold a conference on School Equipment for the Teaching of Geography in January 1904, and in connection therewith to arrange for an exhibition of books, maps, and apparatus.

Syllabuses of Instruction in Geography.—The Royal Geographical Society, London, has issued Syllabuses of Instruction in Geography for elementary and for higher schools. These Syllabuses have been prepared in consequence of requests received from the London School Board and the Oxford and Cambridge School Examinations Boards. The Council of the Society appointed a special committee to draw up Syllabuses as guides to instruction in geography in elementary and in secondary schools. After careful consideration of the subject, the committee requested the late Mr. T. G. Rooper, H.M. Inspector of Schools, and Mr. H. J. Mackinder, Reader in Geography at Oxford University, to draft the two Syllabuses —the former that for elementary, and the latter for higher schools. Both Syllabuses were thoroughly discussed by the committee, and many suggestions made. Unfortunately, the sad death of Mr. Rooper deprived the committee of his further valuable co-operation, and Mr. G. G. Chisholm consented to complete the revision of the elementary Syllabus. The Syllabuses have now been issued by the Council of the Society in the hope that they may be of real service as a guide to geographical teaching. Teachers and members of the Royal Scottish Geographical Society may procure copies of these Syllabuses on application to the secretary at the Society's Rooms in Edinburgh.

COMMERCIAL GEOGRAPHY.

New Canal from Brussels to the Sea.—In *La Géographie* some account is given of a new project of converting Brussels into a "seaport." At present a canal, which is a prolongation of the Charleroi canal, connects the city with the Rupel, an affluent of the Escaut. This canal traverses a populous district, but is only large enough to allow of the passage of vessels drawing $3\frac{1}{2}$ metres of water, and not wider than $7\frac{1}{4}$ metres. A new section is to be constructed which will be 3 kilometres 500 in length, and have a minimum breadth of 48 metres. It will join the Rupel about 4 kilometres 500 before the latter pours its waters into the Escaut, but a project is also on foot for improving and shortening the course of portion of the Rupel. An important part of the scheme is the construction of two ports at Brussels in order to facilitate heavy traffic. A local port is to be constructed within the city in the plains of Tour and Taxis, parallel to the great arteries of the Allée Verte and the Avenue Nouvelle, and in the vicinity of the goods station of Tour and Taxis. The basin will measure 900 metres by 120. There will be 1700 metres of available quays, and it is estimated that the port will be able to deal with a traffic up to 1,000,000 tons. The basin will be connected with the canal of Charleroi, and is intended to deal chiefly with internal traffic and the smaller seagoing vessels. In addition to this local port, an avant-port is

to be constructed near Laeken, opposite the Schaerbeck Station, which is to be reserved for the larger seagoing boats.

Trade of Ponta Delgada.—Professor Carlos de Mello, formerly a corresponding member of the Society, has sent us some interesting notes on the harbour and trade of Ponta Delgada, the capital of St. Michael's in the Azores. English ships still largely outnumber those of other nationalities, but the relative preponderance of Britain is diminishing, while that of Germany is largely increasing. Thus in 1899, when British trade reached its maximum, there were 401 British ships with a total tonnage of 1,030,495 tons. In the same year Germany sent 20 ships with a tonnage of 62,223 tons. In 1902 Britain sent 189 ships with a total tonnage of 485,319 tons, while Germany sent 28 ships with a total tonnage of 99,499 tons. Similarly, the trade with Holland and Sweden is also increasing. From Professor Mello's tables, however, it would appear that the total trade of Ponta Delgada is diminishing. It is believed that this is in some part due to the fact that the Admiralty chart of the island states that navigation is impeded by a breach in the breakwater and sunken vessels, but the harbour has now been greatly improved.

Professor de Mello has also sent us a small pamphlet on the Azores, published by the Society for spreading information about the Azores, which contains a large amount of interesting information about the island.

The Trade of Basra.—Mr. Consul Wratislaw describes the trade last year of the district on the Persian Gulf, of which Basra is the commercial centre, as bad compared with 1901, which was itself worse than 1900. The exports amounted last year to a little short of a million sterling, and the imports to $1\frac{1}{4}$ millions. The decline in trade is in exports, and chiefly under the head of cereals, owing to bad winter harvests. The prospects of trade during the current year are good, but there is always the difficulty of inadequate transport, for when the grain crops of the fertile district between the Tigris and Euphrates are harvested and ready for export in June and July, the Euphrates and its branch canals are low, and much of the grain cannot be brought down till late in the autumn. The Turkish authorities have removed the prohibitive export duty on horses, and now Arab horses are shipped as of old direct from Basra to India, instead of being taken clandestinely into Persia and sent from Mohammera. The Persian steamers take in large quantities of wood as well as of petroleum, and the market seems likely to be overstocked with both. Dates, wool, opium, barley, seeds, gall-nuts, and hides are the main exports, while cotton goods absorb nearly 40 per cent. of the imports, and sugar about 10 per cent. The wants of the inland Arabs are few and simple, consisting chiefly of cotton prints for clothing, cotton and silk handkerchiefs for head coverings, sugar, coffee, and enamelled ironware. Hitherto these have been imported through Koweit and Basra, but the constant hostilities between the Emir of Nejd and his competitors have rendered the caravan routes from the East unsafe, and the interior has been supplied through Damascus, and to some extent through Samawa on the lower Euphrates. The cotton goods are almost exclusively from Manchester, the sugar from France, the enamelled ware from Austria, and the silk handkerchiefs from Baghdad and Syria. Firearms reach the people clandestinely through Jibuti, Muskat, and the Persian Gulf ports. The Euphrates steamers are unable to cope with the trade between Basra and Baghdad, and large quantities of cargo accumulate at the former place, while things are made worse by the insecurity of the Tigris, which is such that the transport of valuable goods in sailing lighters has been prohibited. Out of ship-

ping to the extent of 201,513 tons visiting Basra last year 164,341 tons were British, and 4334 tons Russian.

American Immigrants.—According to *Dun's Review*, the immigrants into America during the past fiscal year (ending June 30, 1903) numbered 857,046, the highest number yet attained. The previous maximum was 788,992 in 1882, and the increase on 1902 was 208,303, Italy furnishing one-quarter of the total increase. In detail, the figures for the different nationalities are as follows:—Italy 230,622, Austro-Hungary 206,011, Russia 136,093, Sweden 46,028, Germany 40,086, Ireland 35,310, England 26,219, Norway 24,461, and Japan 19,968; all other countries have furnished less than Japan. Of the total immigrants it is estimated that only thirteen per cent. were bound west of the Mississippi river. The figures as regards Ireland are especially remarkable.

The following further statistics appear in *Questions Diplomatiques et Coloniales* (15th Sept. 1903):—

Decennial Periods.	France.	England.	Scotland.	Ireland.	Germany.	Italy.	Russia and Poland.	Sweden and Norway.	Austria-Hungary	China.
1821 to 1830	8,497	22,167	...	50,724	6,761	408	91	91	..	..
1831 to 1840	45,575	73,143	...	207,381	152,454	2,253	646	1,201	...	...
1841 to 1850	77,262	263,332	3,712	780,719	434,626	1,870	656	13,903	..	35
1851 to 1860	76,358	385,643	38,331	914,119	951,667	9,231	1,621	20,931	...	41,397
1861 to 1870	35,984	568,128	38,768	435,778	787,468	11.728	4,536	109,298	7,800	...
1871 to 1880	72,206	460,479	87,564	436,871	718.182	55,759	52,254	211,245	72,969	123,201
1881 to 1890	50,464	657,488	149,869	655.482	1,452,970	307,309	265,088	568,362	353,719	...
1891 to 1900	36,006	282,304	...	403,496	543,922	655,668	588.866	325,943	597,047	...

It will be observed that while, during the last decennial period, French, English, Irish, German, and Scandinavian emigration to the United States has considerably diminished, that from Italy, Russia, and Poland, and Austria-Hungary has greatly increased. Assuming that these conditions continue, speculations have been made regarding the probable future composition of the population of the United States.

Railway to Kumassi.—On the 1st of October the first train on this railway entered Kumassi. The total length of the line from Sekondi to Kumassi is 180 miles. Work was begun at Sekondi in 1898, but the first section of 40 miles, to Tarkwa, was not finished till 1901. The section from Tarkwa to Kumassi was carried out more rapidly, its 140 miles being laid out in twenty-seven months. The chief difficulties involved have been the thickness of the bush and the scarcity of labour. The total cost is about £1,600,000, and the construction has been carried out by the Gold Coast Colony Government.

Railway Extension in the Rhône Valley.—The long-talked-of railway from Chamonix to Martigny has at length been begun, and at each end the first section is now under construction. When completed the total length of the line will be 24 miles, including 3 miles along the valley from Vernayaz to Martigny, as it has been decided that the junction with the main line is to be at the latter and not at the former station. From Chamonix to Châtelard the new line will be in French territory, and thence to Martigny in Switzerland; and thus the enterprise is evenly divided between the two countries, each having to construct about

12 miles. The French portion presents few engineering difficulties, and there could be no question as to the route to be followed. Starting from the station of the electric railway at Chamonix, the line runs along the open valley with a station for the Chapeau and Mer de Glâce, and then crosses the Arve. Shortly afterwards there will be a station convenient for the ascent of the Flégère. The section ends at Argentière. Here the Col, which forms the watershed between the Chamonix and Rhône valleys, presents some difficulty, and will probably require a short tunnel. When once this Col is surmounted the line runs down the valley by Valorcine to the frontier, which is reached at a bridge crossing the torrent of the Eau Noire at Châtelard.

The problems connected with the Swiss portion were numerous and complicated; and they have only been decided after a discussion lasting some years, in which local interests have played a prominent part. Of the three schemes considered the first was to continue the line from Châtelard, on the right bank of the stream, at the bottom of the ravine, the whole way to Vernayaz, and ending with a tunnel to avoid the Gorge de Trient. This would have been the cheapest and the best for the through traffic, as a rise and fall of 400 feet would have been avoided. But the line would have been almost useless for the villages on either side; and, accordingly, this route found little favour. The second scheme was to follow the Tête Noire road and to pass under the Col de la Forclaz by a long tunnel. This would have made the fortune of the village of Trient, but would have been expensive and certainly much less interesting than the line selected, which is on the left side of the stream by Finhaut, Triquent, Marécottes, and Salvan; and at the places named there are many more hotels than in the Trient Valley. The section now begun is from Vernayaz to Salvan; and, as the latter is about 1500 feet above the former, while they are only about a mile and a half apart as the crow flies, it will be understood that to negotiate this ascent is no easy matter. The line is very much in the shape of the letter S, and it is necessary to use cog-wheels, on the same system as that employed for the Jungfrau Railway, for nearly a mile and a half, and with a gradient of 1 in 5. Once arrived at the Salvan level (3035 feet) the line passes without difficulty through Triquent (3260 feet) to the summit level at Finhaut (4060 feet), and then descends to join the French line at Châtelard. The levels, as stated, present little difficulty; but the construction of the line will be difficult, for it has to run for nearly the whole way on a ledge cut out of the side of a precipitous ravine, with short tunnels whenever a projecting cliff renders this imperative.

It is hoped that the Vernayaz-Salvan section will be completed in time for the season of 1904; and it is also stated that it is anticipated that the Salvan-Finhaut portion will require two years and the Finhaut-Châtelard one more, so the whole line will not be completed till 1907. When finished the railway will certainly be one of the most picturesque and charming in Switzerland, and it will be little of an eyesore as it runs below and generally out of sight of the high road, and for the most part through a forest of firs. Whether it will pay depends on the cost of construction, but a large traffic is almost certain.

Sierra Leone.—The Report for 1902 upon Sierra Leone (Colonial Reports—Annual, No. 389) has been issued as a Parliamentary paper (Cd. 1388-13). In the course of his observations, the Governor, Sir C. A. King-Harman, notes:—"The year just closed has been one of prosperity for the colony. The revenue has largely exceeded that for any previous year, the imports have increased, and, most gratifying sign of all, the exports show a marked increase over those for the past four years—this increase is particularly noticeable in the value and quantity

of the products of the country exported. There has been a general revival in trade, and in the Protectorate the revenue derived from store licences has, in spite of reduction by one-half of the cost of the licence, almost equalled the amount derived from this source in 1901. Marked as has been the improvement in the financial condition of the country in the year under review, it should be still more marked when the products of the rich palm country through which the railway will pass are available for exports. Hitherto, from want of means of transport, the kernels have been allowed to fall and rot on the ground. The terminus at Bo is now within twenty miles of this rich district, and already small consignments of palm kernels are being brought down by rail.

NEW BOOKS.

EUROPE.

Danish Life in Town and Country. By Jessie Brüchner. London: George Newnes, Limited. 3*s.* 6*d. net.*

This is an admirably performed piece of work, well worthy of the series in which it appears. The writer has entered into all the phases of Danish life, and describes them with vividness and simplicity. No one could desire a better introduction to Denmark, its institutions, its customs, and its methods. We have a glimpse into the society and the politics, the school and the university, the church and the press, the ways of the town and the ways of the country, and are left with a good impression of the Danes and the life they live. They have something not only for us to know, but for us to learn, and this book is worthy the perusal not only of the visitor to the country, but of all who desire an acquaintance with the life of the countrymen of our Queen.

AFRICA.

The Portuguese Expedition to Abyssinia in 1541-1543 *as narrated by Castanhoso.* Translated and edited by R. S. Whiteway, B.C.S. London: Printed for the Hakluyt Society, 1902. Pp. 296.

This Expedition, says the editor in his preface, "has to us this special interest, that the English campaign of 1867, with its 12,000 men, started from a point only a few miles distant from Massowa, and joined the route of their predecessors near Senafé. If the Portuguese furthest point south was, as suggested here, the mountain of Amba Sel, it lies but a few miles from the mountain fortress of Magdala stormed by the English."

Again, while the result of the Portuguese Expedition was partly religious and partly political, the British Expedition had no religious aim. Muhammedans and Hindus marched with Christians against a Christian ruler. But while Portugal flung aside, as of no importance, the lives of 400 of her subjects, Britain poured out vast treasure to save the liberty of half a dozen of hers. "The distinction," adds the editor, "is one of national importance, and who shall say that England has lost by her jealousy for the honour of her flag?"

An excellent map of Abyssinia, by Captain A. S. Thomson, C.B., is appended to the volume.

The Advance of our West African Empire. By C. Braithwaite Wallis, of the Cameronians. Late Acting District Commissioner Sierra Leone Protectorate. London: T. Fisher Unwin, 1903. Pp. 318. *Price* 21*s.*

Since 1892 Britain has been employed unceasingly in crushing the power of the many hostile races in West Africa, including those of the interior of Sierra Leone, who rose and plotted for the extermination of the British. In January 1898 Captain Wallis received instructions from the Colonial Office to proceed to West Africa. He reached Freetown, the capital of Sierra Leone, and describes it as "a port of immense importance to Great Britain." It has excellent coaling appliances, a good and sheltered harbour, and is exceedingly well defended. The scenery of this part of Africa is "matchless in its quiet beauty." He describes the Timini rising which he took part in overcoming, and afterwards the defence of Kambia, from which he escaped with his life. Then the Mendis rose and murdered Mr. Hughes, and massacred in a revolting manner British and American men and women. The author went with a force to the relief of Bandajuma. After describing the opening up of the Kittam, operations in Ronietta district, and the end of the rising in April 1899, Captain Wallis devotes chapters to West African Political Administration, Commercial Policy, Fetish and Superstition, Secret Societies, Health and Exercise, and Bush Fighting. It will thus be seen that his book covers a wide field, and when it is added that it is graphically written by one who knows his subject thoroughly, and is accompanied by a fine map of Sierra Leone, compiled in the Intelligence Division, War Office, his interesting volume may be heartily recommended. Especially valuable to those going to West Africa is the chapter on "Health and Exercise," in which the author gives from long personal experience the rules which must be observed in order that the European may pass his time healthily and agreeably under one of the most trying climates in the world, a chapter which closes with the pregnant words of advice, "Observe moderation in all things." We may point out that, during the South African war, directions were given that the candles of the Berkfeldt filters were to be boiled every four days, not "about once a fortnight" as recommended by the author.

AMERICA

Mountaineering in the Sierra Nevada. By Clarence King. London: T. Fisher Unwin, 1903.

This work is practically a reprint of the fourth edition of a work originally published so long ago as 1871, and is an eloquent and enthusiastic description of mountaineering in the Sierra Nevada of California between 1864 and 1873. In addition to brilliant expositions of the dangers and delights of mountain-climbing, we have interesting notes of the inhabitants of the Sierra at a time which has now almost become ancient history.

The Discoveries of the Norsemen in America, with Special Relation to their Early Cartographical Representation. By Joseph Fischer, S.J. Translated from the German by Basil H. Soulsby, B.A. London: Henry Stevens, Son, and Stiles, 1903.

The original edition of this book was reviewed in our pages (vol. xviii. p. 329) on its first appearance. The translation will be welcomed as making Professor Fischer's learned essay available to a wider public. Attention should specially be directed to the extensive bibliography, and to the reproductions of early maps.

GENERAL.

Johann Keppler, der Gesetzgeber der neueren Astronomie. Ein Lebensbild. Von Adolf Müller, S.J. Freiburg im Breisgau: Herder'sche Verlagshandlung, 1903. Pp. ii + 181.

This is a popular character sketch of a remarkable man; the brochure is interesting, and is written with his usual ability by the Professor of Astronomy at Rome; we are already indebted to him for various works. His book on Copernicus will be remembered, and Keppler's life is dealt with upon the same lines.

Previous writers have either dealt solely with Keppler's scientific work, or with the ecclesiastical disputes of his day; our author treats of the life as a whole, and with much success, and whilst it is written for the unlearned, it loses no solid foundation, as chapter and verse are given for the statements which it contains, especially where the present author differs from previous writers. We can commend the book to our readers.

The British Empire Year Book, 1903. An annual statistical volume of reference compiled with the assistance of H.M. Imperial and Colonial Governments. By Edgar G. Wall, Fellow of the Royal Statistical Society. London: Edward Stanford. *Price* £1, 1*s*.

This is the first issue of a new annual whose object is to present in one volume statistical and other official information in regard to the British Empire generally. The United Kingdom and all the parts of the Empire are dealt with in serial order, and under each heading such subjects as administration, agriculture, army, education, finance, foreign trade, judicial statistics, labour, mining, navy, postal statistics, railways, shipping, vital statistics, are discussed. The result is a very imposing volume, containing an enormous mass of information which, owing to the method of arrangement adopted, is available for instant reference. One finds, for example, statistics of the nationality of the seamen employed on sea-going vessels in the British Islands, of the occupations of the inhabitants of the British Islands, of the employment of women and children in factories, and so forth, together with details of the smallest of the dependencies of the Empire. The volume is indeed a mine of information, and gives a very striking picture of the extent and resources of the Empire. It is a most valuable addition to the list of annual books of reference, and the price can only be regarded as extremely moderate. We congratulate Mr. Wall on the completion of an enterprise which must have involved an enormous amount of labour, and cordially recommend the volume to all those desirous of possessing a work of reference which gives in one volume and in an easily accessible form a mass of information in regard to the whole Empire.

Physician and Friend: Alexander Grant, F.R.C.S. Edited by George Smith, C.I.E., LL.D. London: John Murray, 1902. *Price* 10*s*. 6*d*.

Dr. Alexander Grant, the subject of this most interesting memoir, died only four years ago, but his life's main work was completed between the years 1840 and 1860, and of these twenty years the last fifteen were spent for the most part in India. There he held several distinguished posts in the Government medical service, but it is principally as personal friend and physician to the greatest of the Governors-General that he is presented to us in this volume. The time, we hope, has long gone by, when it might be necessary to vindicate the reputation or memory of the Marquis of Dalhousie from the aspersions once freely thrown at

him, as the real author of the Mutiny of 1857—aspersions, the product of ignorance and malice in almost equal proportions. But the stimulating story of the brilliant work of the great Proconsul should never be allowed to sink into oblivion. It seems to be the destiny of England constantly to require men, on whose shoulders she may with confidence place the burden of ruling and governing alien races as well as her own colonies, and for each and all of them a careful study of the life and work of Lord Dalhousie would be most salutary alike for encouragement, for warning, and for instruction. The story of Dalhousie has often been written both by friend and by foe, and it might have been thought that no fresh materials would be found available, at least until the expiry of fifty years after his death, when, in terms of his will, his private papers may be published. But in the volume now before us fresh material of the greatest interest is presented to the reader in the shape of an appreciation of Lord Dalhousie—written by one who was in daily contact with him, and besides that, in most confidential relations to him—and also of letters addressed by Lord Dalhousie to his Physician and Friend. Dr. George Smith, a member of this society, has shown characteristic good judgment and skill as an Editor, in allowing the subject of the memoir, Dr. Grant, to speak greatly for himself, and he has contributed a valuable historical introduction, in which he remarks, that "in spite of what its men have done for science and literature, for civilisation and humanity in the East, no member has yet told the fascinating story of what is now called the Indian Medical Service." We sincerely hope that Dr. Smith himself will undertake a work for which he has special competence, and to which he could do more than ample justice. The volume now before us shows no diminution of the eloquence, gracefulness, and enthusiasm which we are accustomed to find in Dr. Smith's work, and which contribute so justly to his acceptance and popularity with the general public.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Southport: A Handbook of the Town and Surrounding District. Prepared for the British Association, 1903. Southport: Fortune and Chant, 1903.

Observations of a Naturalist in the Pacific between 1896 *and* 1899. By H. B. Guppy, M.B., F.R.S.E. Volume i. Vanua Levu, Fiji: a Description of its Leading Physical and Geological Characters. Demy 8vo. Pp. xx+392. *Price* 15*s. net.* London: Macmillan and Co., 1903.

The Advance of our West African Empire. By C. Braithwaite Wallis, F.G.S., F.R.G.S. Demy 8vo. Pp. xvi+318. *Price* 21*s.* London: T. Fisher Unwin, 1903.

A Tibetan-English Dictionary. By Sarat Chandra Das, C.I.E. Revised and Edited by Graham Sandberg, B.A., and A. William Heyde. Calcutta, 1903.

Climbs and Exploration in the Canadian Rockies. By Hugh E. M. Stutfield and J. Norman Collie, F.R.S. Demy 8vo. Pp. xii+343. *Price* 12*s.* 6*d. net.* London: Longmans and Co., 1903.

The International Geography. By Seventy Authors. Edited by Hugh Robert Mill, D.Sc. Third edition. Demy 8vo. Pp. xx+1088. *Price* 15*s.* London: George Newnes, Ltd., 1903.

China Past and Present. By EDWARD HARPER PARKER. Demy 8vo. Pp. xi + 424. *Price* 10*s.* 6*d.* London: Chapman and Hall, 1903.

Two Awheel and Some Others Afoot in Australia. By ARTHUR JOSE. Crown 8vo. Pp. xi + 216. *Price* 3*s.* 6*d. net.* London: J. M. Dent and Co., 1903.

A Monograph of the Tsetse Flies (Genus *Glossina*, Westwood). Based on the Collection in the British Museum. By ERNEST EDWARD AUSTEN; with a chapter on Mouth-parts by H. J. HANSEN, Ph.D. Med. 8vo. Pp. ix + 319. London: British Museum (Natural History), 1903.

Beautiful Biskra, "The Queen of the Desert." By C. HOWARD TRIPP. Pp. vi + 93. Demy 8vo. *Price* 1*s.* London: Bemrose and Sons, Ltd., 1903.

Formosa Under the Dutch: described from Contemporary Records with Explanatory Notes and a Bibliography of the Island. By Rev. WM. CAMPBELL, F.R.G.S. Demy 8vo. Pp. xiv + 629. *Price* 12*s. net.* London: Kegan Paul, Trench, Trübner and Co., 1903.

The Grand Duchy of Finland. By the Author of *A Visit to the Russians in Central Asia.* Crown 8vo. Pp. 127. *Price* 3*s.* 6*d. net.* London: T. Fisher Unwin, 1903.

Great Benin: Its Customs, Art, and Horrors. By H. LING ROTH. With 275 illustrations. Royal 8vo. Pp. xii + 234. *Price* Halifax: T. King and Sons, Ltd., 1903.

Also the following Reports, etc.:—

The Argentine Year Book, 1903. Buenos Ayres: Published by the South American Publishing Co., Ltd., 1903.

Festschrift zur Begrüssung des 14. *Deutschen Geographentages.* Von Prof. Dr. HASSERT. Köln: Druck von M. Dumont Schauberg, 1903.

Folklore of the Bribri and Brunka Indians in Costa Rica. By Prof. H. PITTIER. 1903.

Di Alcuni Resultati Geografici della Discovery nella Regione Antartica (Quadrante di Ross). Del A. Faustini. Città di Castello.

L'Esodo Eschimese. Del A. Faustini. Pavia.

Chiloé su Estado Actual.—su Colonizacion, su porvenir. Por ALFREDO WEBERS. Santiago de Chili, 1903.

The Mutual Relations of the Sun and Earth. By C. ROBERTSON, M.D. Pp. viii + 59. Edinburgh: St. Giles Printing Company, 1903.

Publishers forwarding books for review will greatly oblige by marking the price *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st July 1903.—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas, Price 3*s.* each). *Forfarshire.*—Sheets XXXV. 5, 6, 11 : XL. 11 ; XLI. (10 and 14) ; XLV. 12 ; XLVI. 1 ; XLVII. 1. *Hebrides* (*Inverness-shire*). —Sheets XXIX. 12 ; XXX. 5, 6, 9, 11, 15 ; XXXI. 10 ; XXXIII. 3, 4, 7, 11 ; XXXIV. 9 ; XXXV. 8, 12 ; XXXIX. 7, 8 ; XLIV. 4 ; XLV. 2, 11 ; XLVI. 3 ; XLVIII. 1. *Inver-*

ness-shire.—Sheets XXVIII. 7, 11, 12; XXIX. 5. *Island of Skye, etc.* (*Inverness-shire*).—Sheets III. 12; VI. 4, 12, 16; VII. 3, 4, 8; IX. 9, 10, 15; X. 8; XVI. 8; XVII. 13; XX. 7; XXI. 5, 11, 16; XXVIII. 3, 8.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Quarter Sheets—Revised, Price 1*s.* each). *Banffshire*.—35 SE. *Kincardineshire*.—17 NE., 17 SE. With contours. *Forfarshire*.—27 NW., 27 NE.; 33 SE.; 34 NE., 34 SW., 34 SE.; 39 NE.; 53 NE., 53 SE.; 54 NE. Full Sheets. *Hebrides* (*Inverness-shire*).—Sheet 58; Price 2*s.* 6*d.* Sheets 21, 49; Price 2*s.* each. *Islands of Skye, Rum, etc.*—Sheet 39; Price 2*s.* 6*d.* *Orkney*.—Sheets 102, 106, 107, 112, 120; Price 2*s.* 6*d.* each. Sheets 79, 104, 110; Price 2*s.* each.

Miscellaneous Maps, six inches to one mile, printed on thin tough paper, and folded in cover. *Stobs Castle, Roxburghshire*.—Parts of Sheets 25, 32; Price 1*s.* 6*d.*

The Zincographs of the undernamed Ordnance Survey Plans having, in many cases, been sold out, reprints have been prepared, and are now ready for sale. All plans hitherto published in sections are filled in complete to their margins or to the county boundary. *Caithness-shire* (*Watten and Wick*). Scale 1 : 2500.—XIX. 13. Now made a full sheet and areas added. The prices below are for coloured copies; uncoloured are 3*s.* each with areas, and 2*s.* 6*d.* without areas. With areas added; coloured price now altered to 3*s.*

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st August 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas. Price 3*s.* each). *Forfarshire*.—Sheets XL. 12; XLVI. 2. *Hebrides* (*Inverness-shire*).—Sheets XXX. 10, 12; XXXI. 6, 9; XXXIII. 8, 12, 16; XXXVIII. 4; XXXIX. 3, 10, 12, 16; XLIV. 10, 11, 14, 15; XLV. 5, 6, (10 and 9); XLVI. 2, 6, 7, 11, 12, 15, 16; XLVIII. 3, 5, 6, 7, 14; L. 2, 6, 7; LV. 6; LVII. 2; LX. 2; LXIV. 3, 11, 12. *Inverness-shire*.—Sheet XXVIII. 10. *Island of Skye, etc.* (*Inverness-shire*).—Sheets XIV. 12; XX. 3, 4; XXI. 7. 12. *Kincardineshire*.—Sheets IX. 9; XIII. 7, 8, 15; XIV. 3.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from Sale.

Six-inch Maps (Quarter Sheets, Revised, with contours; Price 1*s.* each). *Forfarshire*.—27 SW., 27 SE.; 28 SE.; 52 SW.; 54 NW.; 55 NW. Full Sheets—Heliozincographed. *Hebrides* (*Inverness-shire*).—Sheets 5, 6, 10; Price 2*s.* 6*d.* each. Sheet 61; Price 2*s.* *Islands of Skye, Rum, etc.* (*Inverness-shire*).—Sheets 46, 50, 51; Price 2*s.* 6*d.* each. Sheets 18, 36; Price 2*s.* each. *Orkney*.—Sheet 115; Price 2*s.* 6*d.* Engraved, on Copper. *Aberdeenshire*.—Sheets 50, 68, 69, 79, 87, 88, 90, 96, 105; Price 2*s.* 6*d.* each. Sheet 59; Price 2*s.* *Banffshire*.—Sheet 46; Price 2*s.* 6*d.* *Inverness-shire*.—Sheets 45, 46, 46A, (47 and 47A and Island of Skye 48), 57, 58, 70, 71, 72, 73, 85, 86, 88, 96, 99, 100, 102, 106, 116, 118, 124, 130, 131, 132, 136, 143, 151, 152, 154, 160, 161, 162; Price 2*s.* 6*d.* each. Sheets 22, (61 and 46B), (133 and 133A), 145, 146, 155 (164 and 164A), (165 and 159), 169; Price 2*s.* each. *Island of Skye* (*Inverness-shire*).—Sheet 48; Price 2*s.* 6*d.*

One-inch Map (second revision), engraved, in outline. Sheet 26; Price 1*s.* 9*d.*

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th September 1903:—Parish Maps (1 : 2500 Scale, Revised, with Houses ruled, and with areas. Price 3*s.* each). *Forfarshire*.—Sheets XXVIII. 14; XXXV. 2, 13; XL. 5, 8, 14, 15, 16; XLI. 13; XLVI. 6, 8, 9, 10, 11, 14, 15. *Hebrides*

(*Inverness-shire*).—Sheets XXVI. 8; XXXI. 2, 5; XXXIV. 13, 14; XXXIX. 2, 11, 15; XLIV. 12; XLVIII. 4, 10; L. 3, 10, 11, 14, 15; LIII. 1, 2, 6, 9; LV. 10, 14; LVII. 3, 4, 6, 7, 8, 10, 11, 14, 15; LX. 3; LXII. 15; LXIII. 1; LXIV. 7; LXV. 5, 9. *Island of Skye, etc.* (*Inverness-shire*).—Sheets III. 16; IV. 5, 6; VIII. 13; X. 4; XI. 1; XII. 2; XIV. 16; XV. 3, 13; XXI. 2, 6, 10; XXII. 3; XXIII. 1, 5, 6. *Kincardineshire.*—Sheets IX. 1, 5, 6, 10, 11, 13, 14, 15; XIII. 11; XIV. 1, 2; XV. 11, 12, 16.

Note.—There is no coloured edition of these sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps, Revised. *Hebrides* (*Inverness-shire*).—Sheets 3, 7 (14 and 15); Price 2*s.* 6*d.* each. Sheets 1, 9, 24, (37 and 42), 54; Price 2*s.* each. *Islands of Skye, Rum, etc.* (*Inverness-shire*).—Sheets 17, 29, 34, 40, 49, 52, 63; Price 2*s.* 6*d.* each. Sheets 31 (32 and 32A), 56: Price 2*s.* each. Quarter Sheets, with contours; Price 1*s.* each. *Forfarshire.*—39 SE.; 41 NW.; 45 NE.; 47 NW.; 51 NE. *Kincardineshire.*—18 SW.

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ADMIRALTY CHARTS OF SCOTLAND. Firth of Cromarty. Scale 1 : 32,480. Surveyed by Captain W. Usborne Moore, R.N., H.M.S. *Research*, 1898. No. 2167 (248). *Price* 2*s.* 6*d.*

Published by the Admiralty, Sept. 1903.

SCOTLAND. Bartholomew's New Reduced Survey. Scale 2 miles to an inch. Sheet 2, Dumfries and Solway. Sheet 12, Central Perthshire. New Editions 1903. With orographical colouring and roads revised by the Cyclists' Touring Club. *Price* 1*s.* *Mounted on cloth* 2*s.*

John Bartholomew and Co., Edinburgh.

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UNITED STATES. Topographic Sheets on Scales of 1 : 62,500, or about one mile to an inch, 1 : 125,000, or about two miles to an inch. *Price* 5 *cents each Sheet.* (The figures indicate the number of sheets received for each State.) Alabama (1); Arizona (5); California (16); Iowa (2); Indiana (2); Indian Territory (3); Minnesota (2); Montana (1); Maine (4); Maryland (9); Massachusetts (1); Nebraska (1); New Jersey (1); New York (29); North Carolina (5); Oregon (2); Pennsylvania (12); South Dakota (1); Texas (1); Virginia (3); West Virginia (8); Wisconsin (2); Washington (1); Wyoming (3); also Special District Maps of Philadelphia and Vicinity, and Albany and Vicinity.

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City, Norfolk, Rome, Coal Gate, Atoka Mansion Town and Union Town, Coos Bay, Maynardville, Raleigh, Austin, Cranberry, Port Orford, Scotts Bluff, Camp Clarke, Ellensburgh, Oelrichs, Ditney. On Scales of one mile to an inch, and two miles to an inch.

United States Geological Survey Office, Washington, D.C.

AFRICA.

CONGO STATE. Carte du Katanga dressée par K. Droogmans, Secrétaire Général du Département des Finances de l'État Independant du Congo. Échelle = 1 centimètre pour 10 kilomètres. *Bruxelles* 1903.

This is the most complete general map of this region yet published.

NEW ATLASES.

RYLAND'S ATLAS of the Collieries, Iron, Steel, and Tinplate Works, Iron Ore Mines, and Oil Shale Mines of England, Scotland, and Wales, and their position on Rail, Road, and Canal. With Indexes.

Published by the Proprietor of "The Iron Trade Circular," Birmingham.

This atlas consists of eighty-three black and white sketch-maps, most of them on the scale of one inch to a mile. These drafts are devoted to the mapping of the various coalfields, and clearly show no less than 3500 collieries, together with the positions of the various iron and steel works. For business men interested in the coal, iron, and other allied industries, this work should prove useful and interesting.

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UNDER THE DIRECTION OF

SIR JOHN MURRAY K.C.B. F.R.S. D.Sc. AND LAURENCE PULLAR F.R.S.E.

LOCH TUMMEL

TAY BASIN

SURVEYED IN 1902 BY T. N. JOHNSTON, M.B., C.M.
JAMES PARSONS, B.Sc., R. M. CLARK, B.Sc., AND D. C. MINTOSH, M.A.

Height of Surface of Water above Sea Level, 454.5 Feet.

Tomintianda
Grenich
Tressait
An Teiseh
Strath Tummel
Burial Ground
Craig Bhor
Craig Bohachoish
Craig Barenich
Craig Barenich Dubh
Craig Stoahanee
Runted Crag
Fraich Wood
Craigan Dubh
Eron Wood
Loch Tummel
Tummel R.
Bun Tummel
Bun Garry
Bun Erigh
Bun Ard
Bun Ruaig
Bun Ochtag
Bun Ochtag
Bun Ochtag

Bathymetrical Survey of the Fresh-water Lochs of Scotland

Under the direction of

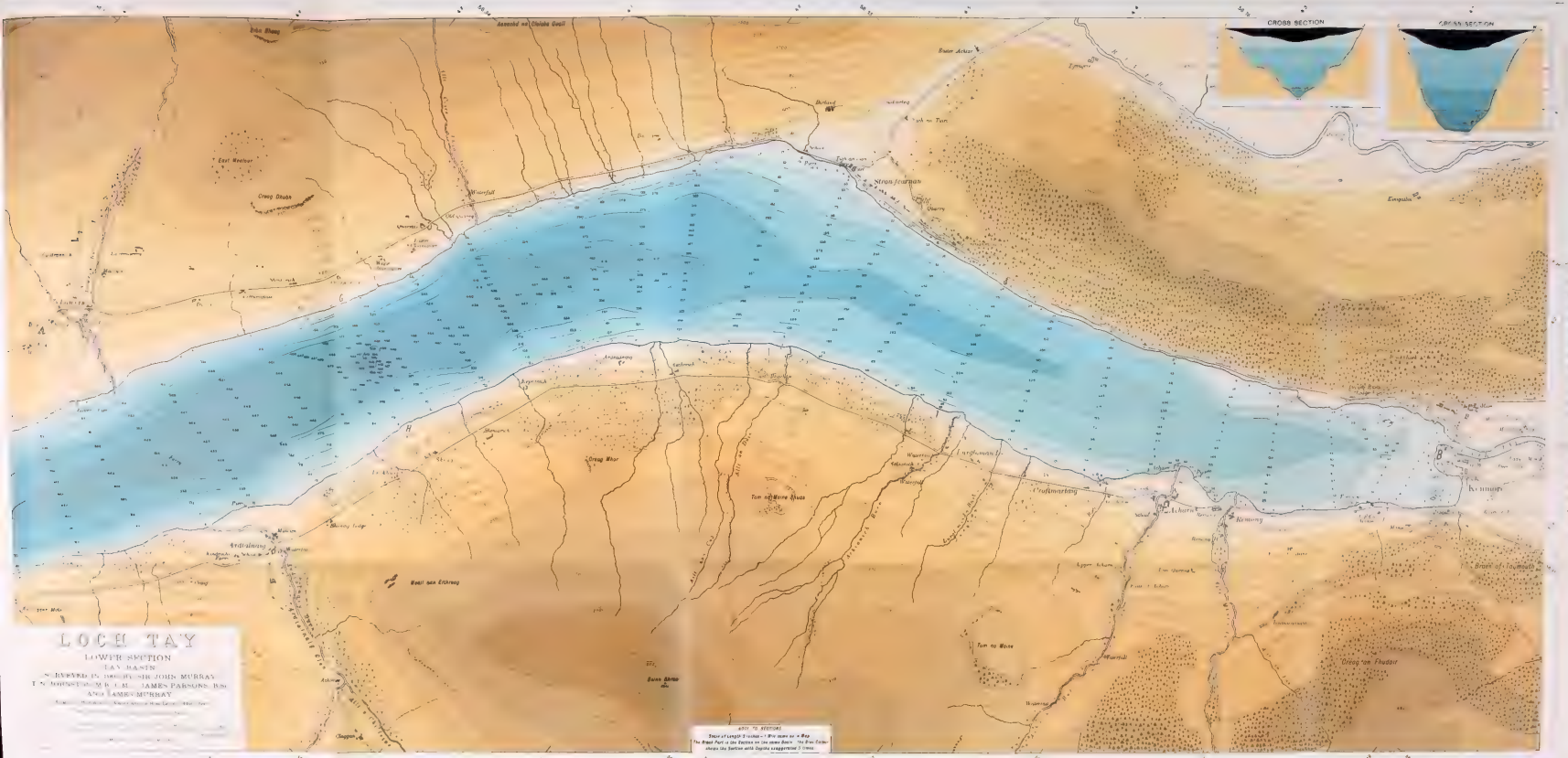
Sir John Murray, K.C.B. F.R.S. D.Sc. and Laurence Pullar, F.R.S.E.

LOCH TAY
UPPER SECTION
TAY BASIN
SURVEYED IN 1902 BY SIR JOHN MURRAY
T N JOHNSTON M.B. C.M. JAMES PARSONS B.Sc.
AND JAMES MURRAY
Height of Surface of Water Above Sea Level 564 Feet
Lochan Breaclaich
Ardeonaig
LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

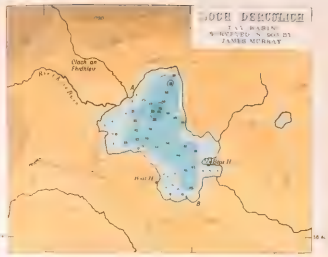
Bathymetrical Survey of the Fresh-water Lochs of Scotland

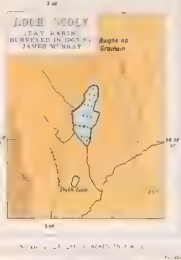
UNDER THE DIRECTION OF

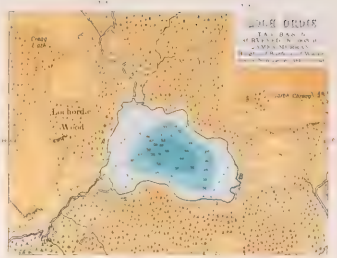
Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., and LAURENCE PULLAR, F.R.S.E.



UNDER THE DIRECTION OF
SIR JOHN MURRAY KCB FRS DSC and LAURENCE PULLAR FRSE

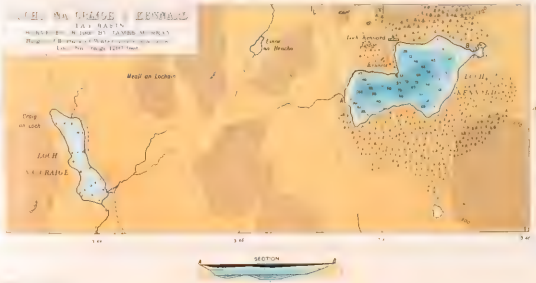


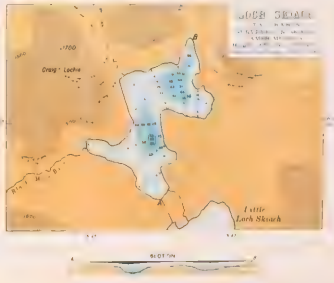




NOTE TO SECTIONS

Scales: Length 2 inches = 1 Mile, same as in Map.
The Black Part in the Section shows the same Basin. The Blue Colour shows the Deep with Depths exaggerated 5 times.





Bathymetrical Survey of the Fresh-water Lochs of Scotland

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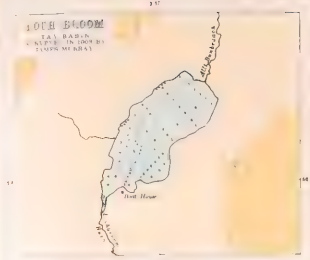
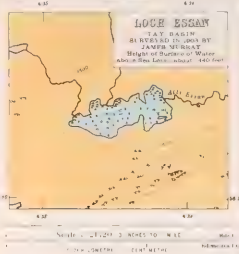
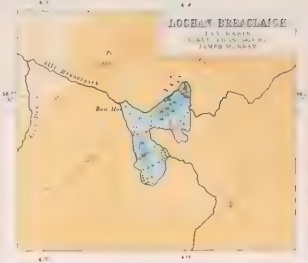






IN THE ICE.

[*Frontispiece.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

NORTH POLAR EXPLORATION—1898–1902.[1]

By Commander R. E. Peary, U.S.N.

Introduction.

In January 1897 I promulgated before the American Geographical Society of New York City my plan for an extended scheme of Arctic exploration, having for its main purpose the attainment of the North Pole. During the spring of 1897 Morris K. Jesup, now President of the Peary Arctic Club, became interested in the matter, and suggested the idea of this Club. His example was followed by other prominent men, and late in May, through the persistent personal efforts of Charles A. Moore, backed by letters from these and other influential men, five years' leave of absence was granted me by the Navy Department to enable me to carry out my plans.

It being too late that season to get the main expedition under way, the summer of 1897 was devoted to a preliminary trip to the Whale Sound region, to acquaint the Eskimos with my plan for the coming year, and set them to work laying in a stock of skins and meat. These objects were successfully accomplished, and, in addition, the great "Ahnighito" meteorite of Melville Bay, the largest known meteorite in the world, was brought home.

In December 1897, while in London, the S.Y. *Windward*, which had been used in his Franz Josef Land expedition, was tendered to me by Alfred Harmsworth, who offered to have her re-engined and delivered to me in New York. This generous offer I accepted.

In the spring of 1898 the Peary Arctic Club was organised, Morris

[1] A Paper read before the Society on November 12.

K. Jesup, Henry W. Cannon, H. L. Bridgman, all personal friends of mine, forming the nucleus about which the rest assembled.

In May the *Windward* arrived, but to my extreme regret and disappointment, she still retained her antiquated and puny engine (the machinists' strike in England prevented the installation of new ones), and was practically nothing but a sailing craft.

The lateness of the season was such that nothing could be done but make the most of the *Windward* as she was. But her extreme slowness ($3\frac{1}{2}$ knots under favourable circumstances) and the introduction of a disturbing factor, in the appropriation by another of my plan and field of work, necessitated the charter of an auxiliary ship if I did not wish to be distanced in my own domain. The *Windward* sailed from New York on the 4th of July 1898, and on the 7th I went on board the *Hope* at Sydney, C.B., and sailed just as the first two-line cablegram came of the battle of Santiago.

1898–1899.

Pushing rapidly northward, and omitting the usual calls at the Danish Greenland ports, Cape York was reached after a voyage, uneventful except for a nip in the ice of Melville Bay which lifted the *Hope* bodily, and for a few hours seemed to contain possibilities of trouble.

The work of hunting walrus and assembling my party of natives was commenced at once; the *Windward* soon joined us, after which the hunting was prosecuted by both ships, until the final rendezvous at Etah, from whence both ships steamed out on August 13, the *Windward* to continue northward, the *Hope* bound for home. The *Windward* was four hours forcing her way through a narrow barrier of heavy ice across the mouth of Foulke Fjord. Here the *Hope* left us, straightening away southward toward Cape Alexander, and the *Windward* headed for Cape Hawkes, showing distinctly beyond Cape Sabine.

At 4 A.M. Sunday we encountered scattered ice off Cape Albert. About noon we were caught in the ice near Victoria Head, and drifted back several miles. Finally we got round Victoria Head into Princess Marie Bay at 6 P.M. The bay was filled with the season's ice, not yet broken out, while Kane Basin was crowded with the heavy, moving polar pack. Between the two, extended northward across the mouth of the bay, was a series of small pools and threads of water, opening and closing with the movements of the tide. At 11.30 P.M. on the 18th, the *Windward* had worried her way across the bay to a little patch of open water close under Cape D'Urville. Here further progress was stopped by a large floe, several miles across, one end resting against the shore, and the other extending out into the heavy ice. While crossing the bay the more important stores had been stowed on the deck in readiness to be thrown out upon the ice in the event of a nip. Pending the turning of the tide, when I hoped the big floe would move and let us proceed, I landed at Cape D'Urville, deposited a small cache of supplies, and climbed the bluffs to look at the conditions northward.

August 21.—I went on a reconnaissance along the ice-foot to the

head of Allman Bay and into the valley beyond. The night of the 21st young ice formed, which did not melt again. On the 28th I attempted to sledge over the sea ice to Norman Lockyer Island, but found too many weak places, and fell back on the ice-foot. The night of the 29th the temperature fell to 13° F., and on the 31st the new ice was four and a quarter inches thick. On this day I went to Cape Hawkes and climbed to its summit, whence I could see lakes out in Kane Basin, but between them and the *Windward* the ice was closely packed—a discouraging outlook. Only a strong and continued westerly wind would give me any chance.

The uncertainty of these two weeks was very annoying to me. Had I been sure that we could not get away from here, I could have been making an inland trip. As it was, I could not leave the ship for fear an opportunity to advance would occur in my absence.

September 2.—I started on a sledge trip up Princess Marie Bay. At Cape Harrison the strong tidal current kept the ice broken, so I could not round it, and the ice-foot was impracticable for sledges. I went on foot to the entrance of Cope's Bay, surveying the shore to that point, then returned to the ship after four days' absence. During this trip I obtained the English record from the cairn on the summit of Norman Lockyer Island, deposited there twenty-two years ago. This record was as fresh as when left.

September 6.—I left the ship to reconnoitre Dobbin Bay, the head of which is uncharted, returning three days later. During this trip the first real snowstorm of the season occurred, five and a half inches falling.

September 12.—One-third of my provisions, an ample year's supply for the entire party, was landed at Cape D'Urville, my Eskimos sledging loads of 700 to 1000 pounds over the young ice. The night of the 13th the temperature dropped to −10° F., and all hope of further advance was at an end.

September 15.—The boiler was blown off and preparations for winter commenced.

On the 17th I broached my plans for the winter campaign as follows:—

The autumn work was simple enough and outlined itself. It comprised two items—the securing of a winter's supply of fresh meat for the party, and the survey of the Buchanan Strait - Hayes Sound - Princess Marie Bay region. In spite of the peculiarly desolate character of that part of the Grinnell Land coast immediately about the *Windward*, and the apparent utter absence of animal life, I felt confident of accomplishing the former. Various reconnaissances thus far on the north shore of Princess Marie Bay had given me little encouragement, but I knew that the Eskimos had killed one or two musk-oxen in years past on Bache Island, and that region looked favourable for them. As regards the survey, a presentiment that I must get at that at the earliest possible moment had already led me to make attempts to reach the head of Princess Marie Bay.

As to the spring campaign, I could not be reconciled to the idea of

losing a year from the main work of the expedition, and proposed to utilise the winter moons in pushing supplies to Fort Conger, then move my party to that station early in February, and on the return of the sun start from there as a base, and make my attempt on the Pole *viâ* Cape Hecla. I *might* succeed in spite of the low latitude of my starting-point, and in any event could be back to the ship before the ice broke up, with thorough knowledge of the coast and conditions north of me.

September 18.—I left the ship with two sledges and my two best

Glacier River.

Eskimos, with provisions for twelve days, for a reconnaissance of Princess Marie Bay.

September 20.—I reached the head of a small fjord running south-west from near the head of Princess Marie Bay, and found a narrow neck of land about three miles wide separating it from a branch of Buchanan "Strait." Bache "Island" of the chart is, therefore, a peninsula, and not an island. From a commanding peak in the neighbourhood I could see that both arms of Buchanan "Strait" ended about south of my position; that the "strait" is in reality a bay, and that Hayes Sound does not exist. On the 21st and 22nd I penetrated the

arms of Princess Marie Bay, designated as Sawyer and Woodward Bays on the charts, and demonstrated them to be entirely closed.

September 23.—While entering a little bight about midway of the north shore of Bache Peninsula, I came upon two bears. These my dog chased ashore, and held at bay until I could come up and kill them.

September 25.—I crossed Bache Peninsula on foot with my two men, from Bear Camp to the intersection of the northern and southern arms of Buchanan Bay. Here we found numerous walrus, and could command the southern arm of the large glacier at its head. Comparatively recent musk-ox tracks convinced me of the presence of musk-ox on the peninsula. The next day I returned to the *Windward* to refit and start for Buchanan Bay *viâ* Victoria Head and Cape Albert, in the quest of walrus and musk-oxen. Henson, in a reconnaissance northward during my absence, had been unable to get more than a few miles beyond Cape Louis Napoleon, sea ice and ice-foot being alike impracticable. A day or two after my return I started him off again to try it.

September 30.—I started for Buchanan Bay. Between Victoria Head and Cape Albert found fresh tracks of a herd of musk-oxen and followed them until obliterated by the wind. Reached the walrus grounds in Buchanan Bay late on October 4, and the next day secured a walrus, and the remainder of my party arrived. The following day every one was out after musk-oxen, but, finding it very foggy on the uplands of the peninsula, I returned to camp and went up to Buchanan Bay in search of bears, the track of which we had seen. Returning to camp, I found that one of my hunters had killed a bull musk-ox.

On the 7th I sent two men to bring out the meat and skin, while I went up Buchanan Bay again. Returning to camp, I found it deserted. A little later some of my party returned, reporting a herd of fifteen musk-oxen killed. The next two days were consumed in cutting up the animals, stacking the meat, and getting the skins and some of the meat out to camp. The latter had to be dragged to the top of the bluffs and thrown over.

October 10.—We started for the ship, which was reached late on the 12th. The ice in Buchanan Bay was very rough, and a snowstorm on the 11th made going very heavy. Five days later, October 17th, I went with two men to locate a direct trail for getting the meat out to the north side of the peninsula, but found the country impracticable, and returned to the ship on the 21st. The sun left on the 20th.

The following week was devoted to the work of preparation for the winter. A reconnaissance of Franklin Pierce Bay developed nothing but hare tracks, but Henson came in from Cope's Bay with a big bear, killed near the head of the bay. This marked the end of the fall campaign, with our winter's fresh meat supply assured, and the Bache "Island"-Buchanan "Strait"-"Hayes Sound" question settled.

The next step was the inauguration of the teaming work, which was to occupy us through the winter. I already had my pemmican and some miscellaneous supplies at Cape Louis Napoleon, and two sledge loads of provisions at Cape Fraser. The rapidly disappearing daylight being now too limited for effective travelling, I was obliged to wait the appear-

ance of the next moon before starting for a personal reconnaissance of the coast northward. On the 29th I left the ship with Henson and one Eskimo. The soft snow of the last two storms compelled me to break a road for the sledges with my snowshoes across Allman Bay and along many portions of the ice-foot, but in spite of this delay, we camped at Cape Louis Napoleon after a long march.

The next day we reached Cape Fraser, having been impeded by the tide rising over the ice-foot, and camped at Henderson's farthest, at the beginning of what seemed an impracticable ice-foot. It was the only possible way of advance, however, as the still moving pack in the channel was entirely impassable. The following day I made a reconnaissance on foot as far as Scoresby Bay, and though the ice-foot was then entirely impracticable for sledges, I was convinced that a good deal of earnest work with picks and shovels, assisted by the levelling effects of the next spring tides, would enable me to get loaded sledges over it during the next moon. From Cape Norton Shaw I could see that by making a detour into Scoresby Bay the heavy pack could be avoided in crossing.

This stretch of ice-foot from Cape Fraser to Cape Norton Shaw is extremely Alpine in character, being an almost continuous succession of huge blocks and masses of bergs and old floes, forced bodily out of the water and up on to the rocks. At Cape John Barrow a large berg had been forced up on the solid rock of the cape, until one huge fragment lay fully one hundred feet above the high-tide level.

Returning from my reconnaissance, I camped again at Cape Fraser, building the first of my snow igloos, which I intended should be constructed at convenient intervals the entire distance to Fort Conger. The next three days were occupied in bringing the supplies at Cape Louis Napoleon up to Cape Fraser, and on the 4th of November I returned to the ship.

The time until the return of the next moon was fully occupied in making and repairing sledges, bringing in beef from the cache on Bache Peninsula, and transporting supplies and dog-food to Cape Hawkes, beyond the heavy going of Allman Bay. During much of this time the temperature was in the $-40°$'s F.

November 21.—Henson and three Eskimos left with loads, and on the 22nd I followed with a party of three to begin the work of the November moon. This work ended just after midnight of December 4th, when the last sledges came in. It left 3300 pounds of supplies and a quantity of dog-food at Cape Wilkes on the north side of Richardson Bay. These supplies would have been left at Cape Lawrence had it not been for the desertion and turning back of one of my men, discouraged with the hard work, while crossing Richardson Bay. Knowing it to be essential to prevent any recurrence of the kind, I pushed on to Cape Wilkes, camped, and turned in after a twenty-five-hour day, slept three hours, then started with empty sledge, eight picked dogs, and an Eskimo driver, to overtake my man. He was found at Cape Louis Napoleon, and after receiving a lesson, was taken along with me to the ship.

My party was left with instructions to bring up supplies which the

wrecking of sledges had obliged me to cache at various places, assemble all at Cape Wilkes, and then, if I did not return, reconnoitre the ice-foot to Rawlings Bay, and return to the ship.

The distance from Cape Wilkes to the *Windward* was sixty nautical miles in a straight line (as travelled by me along the ice-foot and across the bays, not less than ninety statute miles), and was covered in 23 hours and 20 minutes, or 21 hours 30 minutes actual travelling time. Temperature during the run, −50° F.

Every sledge was more or less smashed in this two weeks' campaign, and at Cape John Barrow, sledges and loads had to be carried on our backs over the ice jams. The mean daily minimum temperature for the thirteen days was −41·2° F., the lowest −50° F., which occurred on four successive days.

The experience gained on this trip led me to believe that the conditions of travel from Cape Wilkes northward, as far at least as Cape Defosse, would not differ materially from those already encountered, and enabled me to lay my plans with somewhat greater detail. With the light of the December moon I would proceed to Cape Wilkes with such loads as would enable me to travel steadily without double-banking, advance everything to Cape Lawrence on the north side of Rawlings Bay, then go rapidly on to Fort Conger with light sledges, determine the condition of the supplies left there, that I might know what I could depend upon, and thus save transportation of unnecessary articles, then return to the ship.

In the January moon I would start with my entire party; move my supplies from Cape Lawrence to Fort Conger; remain there till the February moon, the light of which would merge into the beginning of the returning daylight; then sledge the supplies for the polar journey to Cape Hecla, and be in readiness to start from there, with rested and well-fed dogs, by the middle of March.

In pursuance of this plan, the two weeks intervening between the departure of the November moon and the appearance of the December one were busily occupied in repairing and strengthening sledges, and making and overhauling clothing and equipment, to enable us to meet this long and arduous journey in the very midnight of the "Great Night." During this interval the temperature much of the time was at −50° F. and below.

December 20.—In the first light of the returning moon I left the *Windward* with my doctor, Henson, four Eskimos, and thirty dogs, all that were left of the sixty odd of four months previous. Thick weather, strong winds rushing out of Kennedy Channel, heavy snow, and an abominable ice-foot in Rawlings Bay delayed me, and it was not until the 28th that I had all my supplies assembled at Cape Lawrence, on the north side of Rawlings Bay.

Cape Lawrence presented the advantage of two possible routes by which these latter supplies could be reached from Conger, one through Kennedy Channel, which I was about to follow, and the other *viâ* Archer Fjord and overland. In spite of the delays, I felt on the whole well satisfied with the work up to the end of the year. I had all my supplies

half way to Fort Conger, and had comfortable snow igloos erected at Cape Hawkes, Cape Louis Napoleon, Cape Fraser, Cape Norton Shaw, Cape Wilkes, and Cape Lawrence.

December 29.—I started from Cape Lawrence with light sledges for Fort Conger, hoping to make the distance in five days. The first march from Cape Lawrence the ice-foot was fairly good, though an inch or two of efflorescence made the sledges drag as it on sand. The ice-foot grew steadily worse as we advanced, until after rounding Cape Defosse, it was almost impassable even for light sledges. The light of the moon lasted only for a few hours out of the twenty-four, and at its best was not sufficient to permit us to select a route on the sea ice.

Just south of Cape Defosse we ate the last of our biscuit, just north of it the last of our beans. On the next march a biting wind swept down the channel and numbed the Eskimo who had spent the previous winter in the States to such an extent that, to save him, we were obliged to halt just above Cape Cracroft, and dig a burrow in a snowdrift. When the storm ceased, I left him with another Eskimo and nine of the poorest dogs, and pushed on to reach Fort Conger.

The moon had left us entirely now, and the ice-foot was utterly impracticable, and we groped and stumbled through the rugged sea ice as far as Cape Baird. Here we slept a few hours in a burrow in the snow, then started across Lady Franklin Bay. In complete darkness and over a chaos of broken and heaved-up ice, we stumbled and fell and groped for eighteen hours, till we climbed upon the ice-foot of the north side. Here a dog was killed for food.

Absence of suitable snow put an igloo out of the question, and a semi-cave under a large cake of ice was so cold that we could stop only long enough to make tea. Here I left a broken sledge and nine exhausted dogs. Just east of us a floe had been driven ashore, and forced up over the ice-foot till its shattered fragments lay a hundred feet up the talus of the bluff. It seemed impassable, but the crack at the edge of the ice-foot allowed us to squeeze through; and soon after we rounded the point, and I was satisfied by the "feel" of the shore, for we could see nothing, that we were at one of the entrances of Discovery Harbour, but which I could not tell.

Several hours of groping showed that it was the eastern entrance, we had struck the centre of Bellot Island, and at midnight of January 6 we were stumbling through the dilapidated door of Fort Conger. A little remaining oil enabled me, by the light of our sledge cooker, to find the range and the stove in the officers' quarters, and after some difficulty fires were started in both. When this was accomplished, a suspicious "wooden" feeling in my right foot led me to have my kamiks pulled off, and I found to my annoyance that both feet were frosted. Coffee from an open tin in the kitchen, and biscuit from the table in the men's room, just as they had been dropped over fifteen years ago, furnished the menu for a simple but abundant lunch.

A hasty search failing to discover matches, candles, lamps, or oil, we were forced to devise some kind of a light very quickly before our oil burned out. Half a bottle of olive oil, a saucer and a bit of towel, fur-

nished the material for a small native lamp, and this, supplemented by pork fat and lard, furnished us light for several days, until oil was located. Throwing ourselves down on the cots in the officers' rooms, after everything had been done for my feet, we slept long and soundly. Awakening, it was evident that I should lose parts or all of several toes, and be confined for some weeks. The mean minimum temperature during the trip was −51·9° F., the lowest −63° F.

During the following weeks our life at Conger was pronouncedly *à la* Robinson Crusoe. Searching for things in the unbroken darkness of the "Great Night," with a tiny flicker of flame in a saucer, was very like seeking a needle in a haystack. Gradually all the essentials were located, while my two faithful Eskimos brought in empty boxes and barrels and broke them up to feed the fire. The dogs left on Bellot Island were brought in, but several died before they got used to the frozen salt pork and beef, which was all I had to feed them. The natives made two attempts to reach and bring in the two men left at Cape Cracroft, but were driven back both times by the darkness and furious winds. Finally, some ten days after we left the dug-out, they reached it again, and found that the two men, after eating some of their dogs, had started for the ship on foot, the few remaining dogs following them.

On the 18th of February the moonlight and the remaining twilight afforded enough light for a fair day's march in each twenty-four hours; we started for the *Windward*. My toes were unhealed, the bones were protruding through the raw stumps on both feet, and I could hardly stand for a moment. I had twelve dogs left, but their emaciated condition and the character of the road precluded riding by any one but myself. Lashed firmly down, with feet and legs wrapped in musk-ox skin, I formed the only load of one sledge. The other carried the necessary provisions.

On the 28th we reached the *Windward*, every one but myself having walked the entire distance of not less than 250 miles in eleven days. Fortunately for us, and particularly for me, the weather during our return, though extremely cold, was calm, with the exception of one day from Cape Cracroft south, during which the furious wind kept us enveloped in driving snow. The mean minimum daily temperature while we were returning was −56·18° F., reaching the lowest, −65° F., the day we arrived at the *Windward*.

March 3.—I started one of my Eskimos for Whale Sound with a summons to the hunters there to come to me with their dogs and sledges. Between the 3rd and the 14th a party of Eskimos coming unexpectedly, the last of the musk-ox meat on Bache Peninsula was brought to the ship, and another bull musk-ox killed.

March 13.—The final amputation of my toes was performed. Pending the arrival of more natives, I sent a dory to Cape Louis Napoleon to be cached and had dog food and current supplies advanced to Cape Fraser.

March 31.—A contingent of five natives and twenty-seven dogs came in. My messenger had been delayed by heavy winds and rough ice, and the ravages of the dog disease had made it necessary to send to the more southerly settlements for dogs.

April 3.—Henson left with these natives and thirty-five dogs, with the instructions to move the supplies at Cape Lawrence to Carl Ritter Bay, then push on with such loads as he could carry without double-banking to Fort Conger, rest his dogs and dry his clothing, and if I did not join him by that time to start back.

April 19.—My left foot had healed, though still too weak and stiff from long disuse for me to move without crutches. On this day I started for Fort Conger with a party of ten, some fifty dogs, and seven sledges loaded with dog food and supplies for return caches.

April 23.—I met Henson returning with his party at Cape Lawrence. From there I sent back my temporary help and borrowed dogs, and went on with a party of seven, including five natives.

April 28.—We reached Conger.

May 4.—Having dried all our gear and repaired sledges, I started for a reconnaissance of the Greenland north-west coast. I should have started two days earlier but for bad weather. Following a very arduous ice-foot to St. Patrick's Bay, I found the bay filled with broken pack ice covered with snow almost thigh deep. From the top of Cape Murchison, with a good glass, no practicable road could be seen. The following day I sent two men with empty sledges and a powerful team of dogs to Cape Beechy to reconnoitre from its summit. Their report was discouraging. Clear across to the Greenland shore, and up and down as far as the glass could reach, the channel was filled with upheaved floe fragments, uninterrupted by young ice or large floes, and covered with deep snow.

Crippled as I was, and a mere dead weight on the sledge, I felt that the road was impracticable. Had I been fit and in my usual place, ahead of the sledges breaking the ice with my snow-shoes, it would have been different. One chance remained—that of finding a passage across to the Greenland side at Cape Lieber.

Returning to Conger, I sent Henson and one Eskimo off immediately on this reconnaissance, and later sent two men to Musk-Ox Bay to look for musk-oxen. Two days afterward they returned reporting sixteen musk-oxen killed, and Henson came in on the same day, reporting the condition of the channel off Capes Lieber and Cracroft the same as that off Capes Beechy and Murchison, and that they had been unable to get across. I now gave up the Greenland trip, and perhaps it was well that I did so, as the unhealed place on my right foot was beginning to break down and assume an unhealthy appearance from its severe treatment. As soon as the musk-ox skins and beef were brought in, the entire party, except myself and one Eskimo, went to the Bellows and Black Rock Vale for more musk-oxen. Twelve were killed here, and the skins and meat brought to Conger.

Not believing it desirable to kill more musk-oxen, and unable to do any travelling north, I completed the work of securing the meat and skins obtained; getting the records and private papers of the United States International Expedition together; securing, as far as possible, collections and property; housing material and supplies still remaining serviceable, and making the house more comfortable for the purposes of my party.

May 23.—We started for the ship, carrying only the scientific records of the expedition, the private papers of its members, and necessary supplies. I was still obliged to ride continuously. Favoured with abundant light and continuously calm weather, and forcing the dogs to their best, the return to the ship was accomplished in six days, arriving there May 29.

During my absence Captain Bartlett had built at Cape D'Urville, from plans which I had furnished him, a comfortable house of the boxes of supplies, double roofed with canvas, and banked in with gravel.

June 1.—I sent one sledge load of provisions to Cape Louis Napoleon, and four to Cape Norton Shaw.

June 6.—I sent three loads to Carl Ritter Bay, and two to Cape Lawrence. On the 25th of June the last of these sledges returned to the *Windward*, and the year's campaign to the north was ended. The return from Carl Ritter Bay had been slow owing to the abundance of water on the ice-foot and the sea ice of the bays, and the resulting sore feet of the dogs.

June 28.—A sufficient number of dogs had recovered from the effect of their work to enable me to make up two teams, and Henson was sent with these, four of the natives and a dory, to make his way to Etah and communicate with the summer ship immediately on her arrival, so that her time would not be wasted even should the *Windward* be late in getting out of the ice.

June 29.—I started with two sledges and three natives to complete my survey of Princess Marie and Buchanan Bays, and make a reconnaissance to the westward from the head of the former. My feet, which I had been favouring since my return from Conger, were now in fair condition, only a very small place on the right one remaining unhealed. Travelling and working at night, and sleeping during the day, I advanced to Princess Marie Bay, crossed the narrow neck of Bache Peninsula, and camped on the morning of July 4 near the head of the northern arm of Buchanan Bay. Hardly was the tent set up when a bear was seen out in the bay, and we immediately went in pursuit, and in a short time had him killed. He proved to be a fine large specimen.

While after the bear I noticed a herd of musk-oxen a few miles up the valley, and after the bear had been brought into camp and skinned, and we had snatched a few hours' sleep, we went after the musk-oxen. Eight of these were secured, including two fine bulls and two live calves, the latter following us back to camp of their own accord. The next three days were occupied in getting the beef to camp. I then crossed to the southern arm of Buchanan Bay, securing another musk-ox. Returning to Princess Marie Bay, I camped on the morning of the 14th at the glacier which fills the head of Sawyer Bay.

During the following six days I ascended the glacier, crossed the ice-cap to its western side, and from elevations of from 4000 to 4700 feet looked down upon the snow-free western side of Ellesmere Land, and out into an ice-free fjord, extending some fifty miles to the north-west. The season here was at least a month earlier than on

the east side, and the general appearance of the country reminded me of the Whale Sound region of Greenland. Clear weather for part of one day enabled me to take a series of angles, then fog and rain and snow settled down upon us. Through this I steered by compass back to and down the glacier, camping on the 21st in my camp of the 15th.

The return from here to the ship was somewhat arduous, owing to the rotten condition of the one-year ice and the deep pools and canals of water on the surface of the old floes. These presented the alternative of making endless detours or wading through water often waist deep. During seven days our clothing, tent sleeping-gear, and food were constantly saturated. The *Windward* was reached on the 28th of July.

In spite of the discomforts and hardships of this trip, incident to the lateness of the season, I felt repaid by its results. In addition to completing the notes requisite for a chart of the Princess Marie-Buchanan Bay region, I had been fortunate in crossing the Ellesmere Land ice-cap, and looking upon the western coast. The game secured during this trip comprised one polar bear, seven musk-oxen, three oogsook, and fourteen seals.

When I returned to the *Windward* she was round in the eastern side of Franklin Pierce Bay. A party had left two days before with dogs, sledge, and boat, in an attempt to meet me and supply me with provisions. Three days were occupied in communicating with them and getting them and their outfit on board. The *Windward* then moved back to her winter berth at Cape D'Urville, took the dogs on board, and on the morning of Wednesday, August 2, got under way.

During the next five days we advanced some twelve miles, when a southerly wind jammed the ice on us and drifted us north, abreast of the starting-point. Early Tuesday morning, the 8th, we got another start, and the ice gradually slackening, we kept under way, reached open water a little south of Cape Albert, and arrived at Cape Sabine at 10 P.M.

At Cape Sabine I landed a cache and then steamed over to Etah, arriving at 5 A.M. of the 9th. Here we found mail, and learned that the ss. *Diana*, which the club had sent up to communicate with me, was out after walrus. Saturday morning the *Diana* returned, and I had the great pleasure of taking Secretary Bridgman, commanding the Club's expedition, by the hand.

Though the year had not been marked by any startling results, it was a year of hard and continuous work for the entire party. During the year I obtained the material for an authentic map of the Buchanan Bay, Bache Peninsula, Princess Marie Bay region; crossed the Ellesmere Land ice-cap to the west side of that land, established a continuous line of caches from Cape Sabine to Fort Conger, containing some fourteen tons of supplies; rescued the original records and private papers of the Greely expedition; fitted Fort Conger as a base for future work, and familiarised myself and party with the entire region as far north as Cape Beechy.

With the exception of the supplies at Cape D'Urville, all the pro-

visions, together with the current supplies and dog food (the latter an excessive item), had been transported by sledge.

Finally, discouraging as was the accident to my feet, I was satisfied, since my effort to reach the north-west coast of Greenland from Conger in May, that the season was one of extremely unfavourable ice condition north of Cape Beechy, and doubt, even if the accident had not occurred, whether I should have found it advisable, on reaching Cape Hecla, to attempt the last stage of the journey.

My decision not to attempt to winter at Fort Conger was arrived at after careful consideration. Two things controlled this decision : First, the uncertainty of carrying dogs through the winter ; and second, the comparative facility with which the distance from Etah to Fort Conger can be covered with light sledges.

After the rendezvous with the *Diana*, I went on board the latter ship, and visited all the native settlements, gathering skins and material for clothing and sledge equipment, and recruiting my dog teams. The *Windward* was sent walrus hunting during my absence. The *Diana* also assisted in this work.

August 25.—The *Windward* sailed for home, followed on the 28th by the *Diana*, after landing me with my party, equipment, and additional supplies at Etah.

1899-1900.

The *Diana* seemed to have gathered in and taken with her all the fine weather, leaving us a sequence of clouds, wind, fog, and snow, which continued with scarcely a break for weeks.

After her departure the work before me presented itself in its own natural sequence as follows : Protect the provisions, construct our winter quarters, then begin building sledges, and grinding walrus meat for dog pemmican for the spring campaign.

During the first month a number of walrus were killed from our boats off the mouth of the fjord, then the usual Arctic winter settled down upon us, its monotony varied only by the visits of the natives, occasional deer hunts, and a December sledge journey to the Eskimo settlements in Whale Sound as far as Kangerd-looksoah. In this nine-days' trip some 240 miles were covered in six marches, the first and the last marches being 60 to 70 miles. I returned to Etah just in time to escape a severe snowstorm, which stopped communication between Etah and the other Eskimo settlements completely, until I sent a party with snowshoes, and a specially constructed sledge, carrying no load, and manned by double teams of dogs, to break the trail.

During my absence some of my natives had crossed to Mr. Stein's place at Sabine, and January 9 I began the season's work by starting a few sledge loads of dog food for Cape Sabine, for use of my teams in the spring journey. From this time on as the open water in Smith Sound permitted, more dog food was sent to Sabine, and as the light gradually increased, some of my Eskimos were kept constantly at Sonntag Bay some twenty miles to the south, on the lookout for walrus.

My general programme for the spring work was to send three

divisions of sledges north as far as Conger, the first to be in charge of Henson, while I brought up the rear with the third.

From Conger I should send back a number of Eskimos, retain some at Conger, and with others proceed north from there either *viâ* Hecla or the north point of Greenland, as circumstances might determine.

I wanted to start the first division on the 15th of February, the second a week later, and leave with the third March 1, but a severe storm, breaking up the ice between Etah and Littleton Island, delayed the departure of the first division of seven sledges until the 19th.

Kangerd-looksoah.

The second division of six sledges started on the 26th, and March 4 I left with the rear division of nine sledges. Three marches carried us to Cape Sabine, along the curving northern edge of the north water. Here a northerly gale with heavy drift detained me for two days. Three more marches in a temperature of $-40°$ F. brought me to the house at Cape D'Urville. Records here informed me that the first division had been detained here a week by stormy weather, and the second division had left but two days before my arrival. I had scarcely arrived when two of Henson's Eskimos came in from Richardson Bay, where one of them had severely injured his leg by falling under a sledge. One day was spent at the D'Urville house drying our clothing, and on the 13th I got away on the trail of the other divisions with seven sledges, the injured man going to Sabine with the supporting party.

I hoped to reach Cape Louis Napoleon on this march, but the going was too heavy, and I was obliged to camp in Dobbin Bay about five miles short of the cape.

The next day I hoped on starting to reach Cape Fraser, but was again disappointed, a severe windstorm compelling me to halt a little south of Hayes Point, and hurriedly build snow igloos in the midst of a blinding drift.

All that night and the next day and the next night the storm continued. An early start was made on the 16th, and in calm but very thick weather we pushed on to Cape Fraser. Here we encountered the wind and drift full in our faces and violent, making our progress from here to Cape Norton Shaw along the ice-foot very trying.

The going from here across Scoresby and Richardson Bays was not worse than the year before; and from Cape Wilkes to Cape Lawrence the same as we had always found it. These two marches were made in clear but bitterly windy weather.

Another severe southerly gale held us prisoners at Cape Lawrence for a day. The 20th was an equally cruel day, with wind still savage in its strength, but the question of food for my dogs gave me no choice but to try to advance. At the end of four hours we were forced to burrow into a snow-bank for shelter, where we remained till the next morning.

In three more marches we reached Cape von Buch. Two more days of good weather brought us to a point a few miles north of Cape Defosse. Here we were stopped by another furious gale with drifting snow, which prisoned us for two nights and a day.

The wind was still bitter in our faces when we again got under way the morning of the 27th, the ice-foot became worse and worse up to Cape Cracroft, where we were forced down into the narrow tidal joint at the base of the ice-foot; this path was a very narrow and tortuous one, frequently interrupted, and was extremely trying on men and sledges. Cape Lieber was reached on this march. At this camp the wind blew savagely all night, and in the morning I waited for it to moderate, before attempting to cross Lady Franklin Bay.

While thus waiting, the returning Eskimos of the first and second divisions came in. They brought the very welcome news of the killing of twenty-one musk-oxen close to Conger. They also reported the wind out in the bay as less severe than at the Cape.

I immediately got under way and reached Conger just before midnight of the 28th, twenty-four days from Etah, during six of which I was held up by storms.

The first division had arrived four days and the second two days earlier. During this journey there had been the usual annoying delays of broken sledges, and I had lost numbers of dogs.

The process of breaking in the tendons and muscles of my feet to their new relations, and the callousing of the amputation scars, in this, the first serious demand upon them, had been disagreeable, but was, I believed, final and complete. I felt that I had no reason to complain.

The herd of musk-oxen so opportunely secured near the station, with

the meat cached here the previous spring, furnished the means to feed and rest my dogs. A period of thick weather followed my arrival at Conger, and not until April 2 could I send back the Eskimos of my division.

On leaving Etah I had not decided whether I should go north from Conger *viâ* Cape Hecla, or take the route along the north-west coast of Greenland. Now I decided upon the latter. The lateness of the season and the condition of my dogs might militate against a very long journey; and if I chose the Hecla route and failed of my utmost aims, the result would be complete failure. If, on the other hand, I chose the Greenland route and found it impossible to proceed northward over the pack, I still had an unknown coast to exploit, and the opportunity of doing valuable work. Later developments showed my decision to be a fortunate one.

I planned to start from Conger the 9th of April, but stormy weather delayed the departure until the 11th, when I got away with seven sledges.

At the first camp beyond Conger my best Eskimo was taken sick, and the following day I brought him back to Conger, leaving the rest of the party to cross the channel to the Greenland side, where I would overtake them. This I did two or three days later, and we began our journey up the north-west Greenland coast. As far as Cape Sumner we had almost continuous road-making through very rough ice. Before reaching Cape Sumner we could see a dark water sky, lying beyond Cape Brevoort, and knew that we should find open water there.

From Cape Sumner to Polaris Boat Camp in Newman Bay we cut a continuous road. Here we were stalled until the 21st by continued and severe winds. Getting started again in the tail end of the storm, we advanced as far as the open water a few miles east of Cape Brevoort, and camped. This open water about three miles wide at the Greenland end extended clear across the mouth of Robeson Channel to the Grinnell Land coast, where it reached from Lincoln Bay to Cape Rawson. Beyond it to the north and north-west as far as could be seen, were numerous lanes and pools. The next day was devoted to hewing a trail along the ice-foot to Repulse Harbour, and on the 23rd, in a violent gale accompanied by drift, I pushed on to the "Drift Point" of Beaumont (and later Lockwood), a short distance west of Black Horn Cliffs.

The ice-foot as far as Repulse Harbour, in spite of the road-making of the previous day, was very trying to sledges, dogs, and men. The slippery side slopes, steep ascents, and precipitous descents wrenched and strained the latter, and capsized, broke, and ripped shoes from the former.

I was not surprised to see from the "Drift Point" igloo that the Black Horn Cliffs were fronted by open water. The pack was in motion here, and had only recently been crushing against the ice-foot, where we built our igloo. I thought I had broken my feet in pretty thoroughly on my journey from Etah to Conger, but this day's work of handling a sledge along the ice-foot made them think they had never encountered any serious work before. A blinding snowstorm on the 24th kept us

inactive. The next day I made a reconnaissance to the Cliffs, and the next day set the entire party to work hewing a road along the ice-foot. That night the temperature fell to -25° F., forming a film of young ice upon the water. The next day I moved up close to the Cliffs, and then with three Eskimos reconnoitred the young ice. I found that by proceeding with extreme care it would in most places support a man.

With experienced Ahsayoo ahead constantly testing the ice with his seal spear, myself next, and two Eskimos following, all with feet wide apart and sliding instead of walking, we crept past the Cliffs. Returning we brushed the thin film of newly fallen snow off the ice with our feet for a width of some four feet, to give the cold free access to it.

I quote from my diary for the 27th. "At last we are past the barrier, which has been looming before me for the last ten days, the open water at the Black Horn Cliffs. Sent two of my men, whose nerves are disturbed by the prospect ahead, back to Conger. This leaves me with Henson and three Eskimos. My supplies can now be carried on the remaining sledges. Still further stiffened by the continuous low temperature of the previous night, the main sheet of new ice in front of the Cliffs was not hazardous, as long as the sledges kept a few hundred feet apart, did not stop, and their drivers kept some yards away to one side. Beyond the limit of my previous day's reconnaissance there were areas of much younger ice which caused me considerable apprehension, as it buckled to a very disquieting extent beneath dogs and sledges, and from the motion of the outside pack, was crushed up in places, while narrow cracks opened up in others. Finally, to my relief, we reached the ice-foot beyond the Cliffs and camped."

The next day there was a continuous lane of water 100 feet wide along the ice-foot by our camp, and the space in front of the Cliffs was again open water. We crossed just in time.

Up to Cape Stanton we had to hew a continuous road along the ice-foot. After this the going was much better to Cape Bryant. Off this section of the coast the pack was in constant motion, and an almost continuous lane of water extended along the ice-foot. A little west of Cape Bryant I killed two musk-oxen, the flesh of which my dogs highly appreciated. A long search at Cape Bryant finally discovered the remains of Lockwood's cache and cairn, which had been scattered by bears. At 3.30 P.M. the 1st of May I left Cape Bryant to cross the wide indentation lying between Cape Bryant and Cape Britannia. Three marches, mostly in thick weather and over alternating hummocky blue ice and areas of deep snow, brought us at 1 A.M. of the 4th to Cape North (the northern point of Cape Britannia Island). From this camp, after a sleep, I sent back two more Eskimos and the twelve poorest dogs, leaving Henson, one Eskimo, and myself with three sledges and sixteen dogs for the permanent advance party.

From Cape North, a ribbon of young ice, on the so-called tidal crack which extends along this coast, gave us a good lift nearly across Nordenskjöld Inlet. Then it became unsafe, and we climbed a heavy rubble barrier to the old floe ice inside, which we followed to Cape Benet and camped. Here we were treated to another snowstorm.

Another strip of young ice gave us a passage nearly across Mascart Inlet, until, under Cape Payer, I found it so broken up that two of the sledges and nearly all of the dogs got into the water before we could escape from it. Then a pocket of snow, thigh and waist deep, over rubble ice under the lee of the Cape, stalled us completely. I pitched the tent, fastened the dogs, and we devoted the rest of the day to stamping a road through the snow with our snowshoes. Even then, when we started the next day, I was obliged to put two teams to one sledge in order to move it.

Cape Payer was a hard proposition. The first half of the distance round it we were obliged to cut a road, and on the last half, with twelve dogs and three men to each sledge to push and pull them, snow-plough fashion, through the deep snow.

Distant Cape was almost equally inhospitable, and it was only after long and careful reconnaissance that we were able to get our sledges past, along the narrow crest of the huge ridge of ice forced up against the rocks. After this we had comparatively fair going, on past Cape Ramsay, Dome Cape, and across Meigs Fjord as far as Mary Murray Island. Then came some heavy going, and at 11.40 P.M. of May 8 we reached Lockwood's cairn on the north end of Lockwood Island. From this cairn I took the record and thermometer deposited there by Lockwood eighteen years before. The record was in a perfect state of preservation.

One march from here carried us to Cape Washington. Just at midnight we reached the low point, which is visible from Lockwood Island, and great was my relief to see, on rounding this point, another splendid headland, with two magnificent glaciers debouching near it, rising across an intervening inlet. I knew now that Cape Washington was not the northern point of Greenland, as I had feared. It would have been a great disappointment to me, after coming so far, to find that another's eyes had forestalled mine in looking first upon the coveted northern point.

Nearly all my hours for sleep at this camp were taken up by observations and a round of angles. The ice north from Cape Washington was in a frightful condition, utterly impracticable. Leaving Cape Washington, we crossed the mouth of the fjord, packed with blue top floe-bergs, to the western edge of one of the big glaciers, and then over the extremity of the glacier itself, camping near the edge of the second. Here I found myself in the midst of the birthplace of the "floe-bergs," which could be seen in all the various stages of formation. These "floe-bergs" are merely degraded icebergs; that is, bergs of low altitude, detached from the extremity of a glacier, which has for some distance been forcing its way along a comparatively level and shallow sea bottom.

From this camp we crossed the second glacier, then a small fjord, where our eyes were gladdened by the sight of a polar bear, which a couple of bullets from my carbine quickly transformed into dog-meat for my faithful teams. The skin of this bear I have brought back as a trophy for the Club.

It was evident to me now that we were very near the northern extremity of the land, and when we came within view of the next point

ahead, I felt that my eyes rested at last upon the Arctic Ultima Thule (Cape Morris Jesup). The land ahead also impressed me at once as showing the characteristics of a musk-ox country.

This point was reached in the next march, and I stopped to take variation and latitude sights. Here my Eskimo shot a hare, and we saw a wolf-track and traces of musk-oxen. A careful reconnaissance of the pack to the northward, with glasses, from an elevation of a few hundred feet, showed the ice to be of a less impracticable character than it was north of Cape Washington. What were evidently water clouds showed very distinctly on the horizon. This water sky had been apparent ever since we left Cape Washington, and at one time assumed such a shape that I was almost deceived into taking it for land. Continued careful observation destroyed the illusion. My observations completed, we started northward over the pack, and camped a few miles from land.

The two following marches were made in a thick fog, through which we groped our way northward over broken ice, and across gigantic, wave-like drifts of hard snow. One more march in clear weather over frightful going, consisting of fragments of old floes, ridges of heavy ice thrown up to heights of twenty-five to fifty feet, crevasses and holes masked by snow, the whole intersected by narrow leads of open water, brought us at 5 A.M. on the 16th to the northern edge of a fragment of an old floe bounded by water. A reconnaissance from the summit of a pinnacle of the floe, some fifty feet high, showed that we were on the edge of the disintegrated pack, with a dense water sky not far distant.

My hours for sleep at this camp were occupied in observations, and making a transit profile of the northern coast from Cape Washington eastward.

The next day I started back for the land, and having a trail to follow, and no time wasted in reconnaissance, reached it in one long march, and camped.

Leaving this camp on the 18th, as we were travelling eastward on the ice-foot an hour later, I saw a herd of six musk-oxen in one of the coast valleys, and in a short time had secured them. Skinning and cutting up these animals, and feeding the dogs to repletion consumed some hours, and we then resumed our march, getting an unsuccessful shot at a passing wolf as we went.

Within a mile of our next camp a herd of fifteen musk-oxen lay fast asleep; I left them undisturbed. From here on, for three marches, we reeled off splendid distances over good going, in blinding sunshine, and in the face of a wind from the east which burned our faces like a sirocco.

The first march took us to a magnificent cape (Cape Bridgman), at which the northern face of the land trends away to the south-east. This cape is in the same latitude as Cape Washington. The next two carried us down the east coast to the 83rd parallel. In the first of these we crossed the mouth of a large fjord penetrating for a long distance in a south-westerly (true) direction. On the next, in a fleeting glimpse through the fog, I saw a magnificent mountain of peculiar contour which I recognised as the peak seen by me in 1895 from the summit of the interior ice-cap south of Independence Bay, rising proudly above the

land to the north. This mountain was then named by me Mt. Wistar. Finally, the density of the fog compelled a halt on the extremity of a low point, composed entirely of fine glacial drift, and which I judged to be a small island in the mouth of a large fjord.

From my camp of the previous night I had observed this island (?), and beyond and over it a massive block of a mountain, forming the opposite cape of a large intervening fjord, and beyond that again another distant cape. Open water was clearly visible a few miles off the coast, while, not far out, dark water clouds reached away to the south-east.

At this camp I remained two nights and a day, waiting for the fog to lift. Then, as there seemed to be no indications of its doing so, and my provisions were exhausted, I started on my return journey at 3.30 A.M. on the 22nd of May, after erecting a cairn in which I deposited the following record :—

Copy of Record in Cairn at Clarence Wyckoff Island.

Arrived here at 10.30 P.M. May 20 from Etah, *viâ* Fort Conger and north end of Greenland. Left Etah March 4. Left Conger April 15. Arrived north end of Greenland May 13. Reached point on sea ice latitude 83° 50′ N. May 16.

On arrival here had rations for one more march southward. Two days dense fog have held me here. Am now starting back.

With me are my man Mathew Henson; Ahngmalokto, an Eskimo: sixteen dogs and three sledges.

This journey has been made under the auspices of and with funds furnished by the Peary Arctic Club of New York City.

The membership of this Club comprises—Morris K. Jesup, Henry W. Cannon, Herbert L. Bridgman, John Flagler, E. C. Benedict, James J. Hill, H. H. Benedict, Fredk. E. Hyde, E. W. Bliss, H. H. Sands, J. M. Constable, C. F. Wyckoff, E. G. Wyckoff, Chas. P. Daly, Henry Parish, A. A. Raven, G. B. Schley, E. B. Thomas, and others.

(Signed) R. E. Peary,
Civil Engineer, U.S.N.

The fog kept company with us on our return almost continuously until we had passed Lockwood Island, but, as we had a trail to follow, did not delay us so much as the several inches of heavy snow that fell in a furious Arctic blizzard, which came rushing in from the polar basin and imprisoned us for two days at Cape Bridgman.

At Cape Morris K. Jesup, the northern extremity, I erected a prominent cairn, in which I deposited the following record :—

Copy of Record in North Cairn.

May 13, 1900—5 A.M.—Have just reached here from Etah *viâ* Fort Conger. Left Etah March 4. Left Conger April 15. Have with me my man Henson; an Eskimo, Ahngmalokto; sixteen dogs and three sledges; all in fair condition. Proceed to-day due north (true) over

sea ice. Fine weather. I am doing this work under the auspices of, and with funds furnished by, the Peary Arctic Club of New York City.

The membership of this Club comprises—Morris K. Jesup, Henry W. Cannon, Herbert L. Bridgman, John H. Flagler, E. C. Benedict, Fredk. E. Hyde, E. W. Bliss, H. H. Sands, J. M. Constable, C. F. Wyckoff, E. G. Wyckoff, Chas. P. Daly, Henry Parish, A. A. Raven, E. B. Thomas, and others.

(Signed) R. E. Peary,
Civil Engineer, U.S.N.

May 17.—"Have returned to this point. Reached 83° 50′ N. Lat. due north of here. Stopped by extremely rough ice intersected by water cracks. Water sky to north. Am now going east along the coast. Fine weather.

May 26.—"Have again returned to this place. Reached point on East Coast about N. lat. 83°. Open water all along the coast a few miles off. No land seen to north or east. Last seven days continuous fogs, wind, and snow. Is now snowing with strong westerly wind. Temperature 20° F. Ten musk-oxen killed east of here. Expect start for Conger to-morrow."

At Cape Washington, also, I placed a copy of Lockwood's record, from the cairn at Lockwood Island, with the following indorsement:—"This copy of the record left by Lieut. J. B. Lockwood and Sergt. (now Colonel) D. L. Brainard, U.S.A., in the cairn on Lockwood Island south west of here, May 16, 1882, is to-day placed by me in this cairn on the farthest land seen by them, as a tribute to two brave men, one of whom gave his life for his Arctic work."

May 29.—For a few minutes on one of the marches the fog lifted, giving us a magnificent panorama of the north coast mountains. Very sombre and savage they looked, towering white as marble with the newly fallen snow, under their low threatening canopy of lead-coloured clouds. Two herds of musk-oxen were passed—one of fifteen and one of eighteen—and two or three stragglers. Four of these were shot for dog food, and the skin of one, killed within less than a mile of the extreme northern point, has been brought back as a trophy for the Club.

Once free of the fog off Mary Murray Island, we made rapid progress, reaching Cape North in four marches from Cape Washington. Clear weather showed us the existence of open water a few miles off the shore, extending from Dome Cape to Cape Washington. At Black Cape there was a large open water reaching from the shore northward. Everywhere along this coast I was impressed by the startling evidences of the violence of the blizzard of a few days before. The polar pack had been driven resistlessly in against the iron coast, and at every projecting point had risen to the crest of the ridge of old ice, along the outer edge of the ice-foot in a terrific cataract of huge blocks. In places these mountains of shattered ice were 100 feet or more in height. The old ice in the bays and fjords had had its outer edge loaded with a great ridge of ice fragments, and was itself cracked and crumpled into huge swells by the resistless pressure. All the young ice which had helped

us on our outward passage had been crushed into countless fragments, and swallowed up in the general chaos.

Though hampered by fog, the passage from Cape North to Cape Bryant was made in twenty-five and a half marching hours. At 7 A.M. of the 6th of June we camped on the end of the ice-foot, at the eastern end of Black Horn Cliffs. A point a few hundred feet up the bluffs commanding the region in front of the Cliffs showed it to be filled by small pieces of old ice held in place against the shore by pressure of the outside pack. It promised at best the heaviest kind of work, with the certainty that it would run abroad at the first release of pressure.

The next day, when about one-third the way across, the ice did begin to open out, and it was only after a rapid and hazardous dash from cake to cake, that we reached an old floe, which after several hours of heavy work allowed us to climb upon the ice-foot of the western end of the Cliffs.

From here on rapid progress was made again, three more marches taking us to Conger, where we arrived at 1.30 A.M. June 10, though the open water between Repulse Harbour and Cape Brevoort, which had now expanded down Robeson Channel to a point below Cape Sumner, and the rotten ice under Cape Sumner hampered us seriously. In passing I took copies of the Beaumont English records from the cairn at Repulse Harbour, and brought them back for the archives of the Club. They form one of the finest chapters of the most splendid courage, fortitude, and endurance, under dire stress of circumstances, that is to be found in the history of Arctic explorations.

In this journey I had determined conclusively the northern limit of the Greenland Archipelago or land group, and had practically connected the coast southward to Independence Bay, leaving only that comparatively short portion of the periphery of Greenland lying between Independence Bay and Cape Bismarck indeterminate. The non-existence of land for a very considerable distance to the northward and north-eastward was also settled, with every indication pointing to the belief that the coast along which we travelled formed the shore of an uninterrupted central polar sea, extending to the Pole, and beyond to the Spitzbergen and Franz Josef Land groups of the opposite hemisphere.

The origin of the floe-bergs and palæocrystic ice was definitely determined. Further than this, the result of the journey was to eliminate this route as a desirable or practicable one by which to reach the Pole. The broken character of the ice, the large amount of open water, and the comparatively rapid motion of the ice, as it swung round the northern coast into the southerly-setting East Greenland current, were very unfavourable features.

During my absence some thirty-three musk-oxen and ten seals had been secured in the vicinity of Conger; caches for my return had been established at Thank God Harbour, Cape Lieber, and Lincoln Bay, and sugar, milk, and tea had been brought up from the various caches between Conger and Cape Louis Napoleon.

July was passed by a portion of the party in the region from

Discovery Harbour westward *via* Black Rock Vale and Lake Hazen, where some forty musk-oxen were secured.

During August and early September various other hunting trips of shorter duration were made, resulting in the killing of some twenty musk-oxen.

1900–1901.

The middle of September I started with Henson and four Eskimos to Lake Hazen to secure musk-oxen for our winter supply, it being evident that my ship would not reach us. Going west as far as the valley of the Very River, by October 4 ninety-two musk-oxen had been killed. Later nine more were secured, making a total of one hundred and one for the autumn hunting.

From the beginning of November to March 6, the greater portion of the time was passed by my party in igloos built in the vicinity of the game killed in various localities from Discovery Harbour to Ruggles River.

April 5.—I left Conger with Henson, one Eskimo, two sledges, and twelve dogs for my northern trip. At the same time the remainder of the party, with two sledges and seven dogs and pups, started south for Capes D'Urville and Sabine to communicate with or obtain tidings of my ship. On reaching Lincoln Bay, it was evident to me that the condition of men and dogs was such as to negative the possibility of reaching the Pole, and I reluctantly turned back.

Arriving at Conger, after an absence of eight days, I found the remainder of my party there. They had returned to Conger after an absence of four days, having proceeded one-third of the distance across Lady Franklin Bay.

Fortunately the night before I arrived, one of the Eskimos secured several musk-oxen above St. Patrick's Bay, which enabled me to feed my dogs before starting south, which I did with the entire party on April 17.

April 30.—At Hayes Point I met the party from the *Windward* attempting to reach Conger, and received my mail, learning that the *Windward* was at Payer Harbour with Mrs. Peary and our little girl on board. After a rest at the D'Urville box-house, I went on to the *Windward*, arriving May 6.

After a few days' rest the work of establishing new caches along the coast northward towards Conger was commenced, and continued until the middle of June.

Then the preparing of Payer Harbour for winter quarters was carried on till July 3, when the *Windward* broke out of the ice and steamed over to the Greenland side.

July was devoted to killing walrus, and one hundred and twenty-eight were secured and transported to Payer Harbour.

August 4.—The *Erik*, sent up by the Club in command of Secretary H. L. Bridgman to communicate with me, arrived at Etah.

The usual tour of visits to the Eskimo settlements was then made, and both ships pressed into the work of hunting walrus until August

24, when the *Windward* proceeded southward, and the *Erik* steamed away to land me and my party and the catch of walrus at Payer Harbour.

A large quantity of heavy ice blocking the way to Payer Harbour, I requested Secretary Bridgman to land me and my party and walrus

Eskimo Boy (two years old).

meat in a small bight, some twelve or fifteen miles south of Cape Sabine, from whence I could proceed to Payer Harbour in my boats or sledges when opportunity offered. This was done, and on the 29th of August the *Erik* steamed away.

1901–1902.

On the 16th of September I succeeded in reaching Payer Harbour,

crossing Rosse Bay partly by sledge and partly by boat, and going overland across Bedford Pim Island.

Soon after this my Eskimos began to sicken, and by November 19 six of them were dead.

During this time I personally sledged much of the material from Erik Harbour to headquarters, and Henson went to the head of Buchanan Bay with some of the Eskimos, and secured ten musk-oxen.

The winter passed quietly and comfortably. Two more musk-oxen were secured in Buchanan Bay, and six deer at Etah.

January 2.—Work was begun in earnest on preparations for the spring campaign, which opened on the 11th of February. On this day I sent off six sledges, with light loads, to select a road across the mouth of Buchanan Bay, and build an igloo abreast of Cape Albert. On the 12th I sent two of my best hunters on a flying reconnaissance and bear hunt in the direction of Cape Louis Napoleon.

On the 13th eight sledges went out, taking dog food nearly to Cape D'Urville. On the 16th my two scouts returned with a favourable report; and on the 18th ten sledges went out loaded with dog food to be taken to Cape Louis Napoleon. This party returned on the 22nd.

On the evening of the 28th everything was in readiness for Henson to start the next day, it being my intention to send him on ahead with three picked men and light loads to pioneer the way to Conger, I to follow a few days later with the main party.

A northerly gale delayed his departure until the morning of March 3, when he got away with six sledges and some fifty dogs. Two of these sledges were to act as a supporting party as far as Cape Lawrence.

At 9 A.M. of March 6 fourteen sledges trailed out of Payer Harbour and rounded Cape Sabine for the northern journey, and at noon I followed them with my big sledge, the "Long Serpent," drawn by a team of ten fine grays. Two more sledges accompanied me. The temperature at the time was $-20°$ F. The minimum of the previous night had been $-38°$ F.

We joined the others at the igloos abreast of Cape Albert, and camped there for the night. Temperature $-43°$ F.

The next day we made Cape D'Urville in temperature from $-45°$ to $-49°$ F.

Here I stopped a day to dry our footgear thoroughly, and left on the morning of the 9th with some supplies from the box-house. Two sledges returned from here. Camped about five miles from Cape Louis Napoleon. The next march carried me to Cape Fraser, and the next to Cape Collinson. During this march, for the first time in the four seasons that I have been over this route, I was able to take a nearly direct course across the mouth of Scoresby Bay, instead of making a long detour into it.

One march from Cape Collinson carried me to Cape Lawrence, on the north side of Rawlings Bay.

The crossing of this bay, though more direct than usual, was over extremely rough ice. Learning from Henson's letter at Cape Lawrence that I had gained a day on him, and not wanting to overtake him

before reaching Conger, I remained here a day, repairing several sledges which had been damaged in the last march. Five men, with the worst sledges and poorest dogs, returned from here.

Three more marches took us to Cape von Buch, on the north side of Carl Ritter Bay, temperature ranging from -35° to -45° F. Heavy going in many places.

Two more marches carried us to the first coast valley north of Cape Defosse. I had now gained two days on the advance party. The character of the channel ice being such that we were able to

Supporting Party at Cape Lawrence.

avoid the terrible ice-foot which extends from here to Cape Lieber, and my dogs being still in good condition, I made a spurt from here and covered the distance to Conger in one march, arriving about an hour and a half after Henson and his party.

I had covered the distance from Payer Harbour to Conger, some 300 miles, in twelve marches.

Four days were spent at Conger overhauling sledges and harness, drying and repairing clothing, and scouting the country, as far as The Bellows, in search of musk-oxen. None were seen, but about 100 hares were secured in the four days. Temperature during this time from

-40° to -57° F. Seven Eskimos returned from here, taking with them the instruments of the Lady Franklin Bay Expedition, and other items of Government property abandoned here in 1883.

On the morning of the 24th I started north with nine sledges. We camped the first night at "Depot B." The next march I had counted on making Lincoln Bay, but just before reaching Wrangel Bay a sudden furious gale with blinding drift drove us into camp at the south point of the bay. Here we were stormbound during the 26th, but got away on the morning of the 27th and pushed on to Cape Union, encountering along this portion of the coast the steep side slopes of hard snow, which are so trying to men and sledges and dogs.

Open water, the clouds over which we saw from Wrangel Bay Camp, was about 100 yards beyond our igloo, and extended from there, as I judged, northward beyond Cape Rawson, and reached entirely across the channel to the Greenland coast at Cape Brevoort, as in 1900.

Fortunately, with the exercise of utmost care, and at the expense of a few narrow escapes and incessant hard work, we were able to work our sledges along the narrow and villainous ice-foot to and around Black Cape.

The ice-foot along this section of the coast was the same as was found here by Egerton and Rawson in 1876, and Pavy in 1882, necessitating the hewing of an almost continuous road; but a party of willing, light-hearted Eskimos makes comparatively easy work of what would be a slow and heart-breaking job for two or three white men. Beyond Black Cape the ice-foot improved in character, and I pushed along to camp at the *Alert's* winter quarters. Simultaneously with seeing the *Alert's* cairn three musk-oxen were seen a short distance inland, which I went away after and secured. The animals were very thin, and furnished but a scant meal for my dogs.

One march from here carried us to Cape Richardson, and the next under the lee of View Point, where we were stopped, and driven to build our igloo with all possible speed, by one of the common Arctic gales. There were young ice, pools of water, and a nearly continuous water sky all along the shore.

As the last march had been through deep snow, I did not dare to attempt the English short cut across Fielden Peninsula behind Cape Joseph Henry, preferring to take the ice-foot route round it.

For a short distance this was the worst bit of ice-foot I have ever encountered. By the slipping of my sledge two men nearly lost their lives, saving themselves by a most fortuitous chance, with their feet already dangling over the crest of a vertical face of ice some 50 feet in height.

At the very extremity of the cape we were forced to pass our sledges along a shelf of ice less than 3 feet in width, glued against the face of the cliff at an elevation which I estimated at the time as 75 feet above the ragged surface of the floe beneath.

On the western side of the cape the ice-foot broadened and became nearly level, but was smothered in such a depth of light snow that

it stalled us and we went into camp. The next day we made Crozier Island.

During April 2 and 3 we were held here by a westerly storm, and the 4th and 5th were devoted to hunting musk-oxen, of which three were secured, two of them being very small.

From here I sent back three Eskimos, keeping Henson and four Eskimos with me.

During this time reconnaissances of the polar pack northward were made with the glasses, from the summit of the island and from Cape Hecla.

The pack was very rough, but apparently not as bad as that which I saw north of Cape Washington two years before.

Though unquestionably a hard proposition, it yet looked as though we might make some progress through it, unless the snow was too deep and soft. This was a detail which the glasses could not determine.

On the morning of April 6 I left Crozier Island, and a few hours later, at the point of Cape Hecla we swung our sledges sharply to the right, and climbed over and down the parapet of the ice-foot on to the polar pack.

As the sledges plunged down from the ice-foot their noses were buried-out of sight, the dogs wallowed belly-deep in the snow, and we began our struggle due northward.

We had been in the field now just a month. We had covered not less than 400 miles of the most arduous travelling in temperatures of from $-35°$ to $-57°$ F., and we were just beginning our work, *i.e.* the conquest of the polar pack, the toughest proposition in the whole wide expanse of the Arctic region.

Some two miles from the cape was a belt of very recent young ice, running parallel with the general trend of the coast. Areas of rough ice caught in this compelled us to exaggerated zigzags, and doubling on our track. It was easier to go a mile round on the young ice than to force the sledge across one of these islands.

The northern edge of the new ice was a high wall of heavily rubbled old ice, through which, after some reconnaissance, we found a passage to an old floe, where I gave the order to build an igloo. We were now about five miles from the land.

The morning of the 7th brought us fine weather. Crossing the old floe we came upon a zone of old floe fragments deeply blanketed with snow. Through the irregularities of this we struggled, the dogs floundering almost useless, occasionally one disappearing for a moment, now treading down the snow round a sledge to dig it out of a hole into which it had sunk, now lifting the sledges bodily over a barrier of blocks, veering right and left, doubling in our track, road-making with snowshoe and pickaxe.

Late in the day a narrow ditch gave us a lift for a short distance, then one or two little patches of level-going, then two or three small old floes, which though deep with snow, seemed like a godsend compared with the wrenching work earlier. Camped in the lee of a large hummock on the northern edge of a small but very heavy old floe. Every one

thoroughly tired, and the dogs utterly lifeless, dropping motionless in the snow as soon as the whip stopped.

We were now due north of Hecla, and I estimated we had made some six miles, perhaps seven, perhaps only five. A day of work like this makes it difficult to estimate distances. This a fair sample of our day's work.

On the 12th we were stormbound by a gale from the west, which hid even those dogs fastened nearest to the igloo. During our stay here the old floe on which we were camped split in two with a loud report, and the ice cracked and rumbled and roared at frequent intervals.

In the first march beyond this igloo we were deflected westward by a lead of practically open water, the thin film of young ice covering it being unsafe even for a dog. A little further on a wide canal of open water deflected us constantly to the north-west and then west, until an area of extremely rough ice prevented us from following it farther. Viewed from the top of a high pinnacle this area extended west and north-west on both sides of the canal, as far as could be seen. I could only camp and wait for this canal, which evidently had been widened (though not newly formed) by the storm of the day before, to close up or freeze over. During our first sleep at this camp there was a slight motion of the lead, but not enough to make it practicable. From here I sent back two more Eskimos.

Late in the afternoon of the 14th the lead began to close, and hastily packing the sledges, we rushed them across over moving fragments of ice. We now found ourselves in a zone of high parallel ridges of rubble ice covered with deep snow. These ridges were caused by successive opening and closing of the lead. When after some time we found a practicable pass through this barrier, we emerged upon a series of very small but extremely heavy and rugged old floes, the snow on them still deeper and softer than on the southern side of the lead. At the end of a sixteen-hour day I called a halt, though we were only two or three miles north of the big lead.

During the first portion of the next march we passed over fragments of very heavy old floes, slowly moving eastward. Frequently we were obliged to wait for the pieces to crush close enough together to let us pass from one to the other. Farther on I was compelled to bear away due east by an impracticable area, extending west, north-west, north, and north-east as far as could be seen, and just as we had rounded this and were bearing away to the north again, we were brought up by a lead some 50 feet wide. From this on, one day was much like another, sometimes doing a little better, sometimes a little worse, but the daily advance, in spite of our best efforts, steadily decreasing. Fog and stormy weather also helped to delay us.

I quote from my journal for April 21st :—

"The game is off. My dream of sixteen years is ended. It cleared during the night and we got under way this morning. Deep snow. Two small old floes. Then came another region of old rubble and deep snow. A survey from the top of a pinnacle showed this extending north, east, and west, as far as could be seen. The two old floes over

which we had just come are the only ones in sight. It is impracticable, and I gave the order to camp. I have made the best fight I knew. I believe it has been a good one. But I cannot accomplish the impossible."

A few hours after we halted, the ice to the north commenced like the sound of heavy surf, and continued during our stay at this camp. Evidently the floes in that direction were crushing together under the influence of the wind, or what was perhaps more probable, from the long continuation of the noise, the entire pack was in slow motion to the east. A clear day enabled me to get observations which showed my latitude to be 84° 17′ 27″ N., magnetic variation 99° W. I took some photos of the camp, climbed and floundered through the broken fragments and waist-deep snow for a few hundred yards north of the camp, gave the dogs a double ration, then turned in to sleep, if possible, for a few hours preparatory to returning.

We started on our return soon after midnight of the 21st. It was very thick, wind from the west, and snowing heavily. I hurried our departure in order to utilise as much of our tracks as possible before they were obliterated. It was very difficult to keep the trail in the uncertain light and driving snow. We lost it repeatedly, when we would be obliged to quarter the surface like bird dogs. On reaching the last lead of the upward march, instead of the open water which had interrupted our progress then, our tracks now disappeared under a huge pressure ridge, which I estimated to be from 75 to 100 feet high. Our trail was faulted here by the movement of the floes, and we lost considerable time in picking it up on the other side. This was to me a trying march. I had had no sleep the night before, and to the physical strain of handling my sledge, was added the mental tax of trying to keep the trail. When we finally camped, it was only for a few hours, for I recognised that the entire pack was moving slowly, and that our trail was everywhere being faulted and interrupted by new pressure ridges and leads, in a way to make our return march nearly if not quite as slow and laborious as the outward one. The following marches were much the same. In crossing one lead I narrowly escaped losing two sledges and the dogs attached to them. Arrived at the "grand canal," as I called the big lead at which I had sent two Eskimos back, the changes had been such as to make the place almost unrecognisable.

Two marches south of the grand canal the changes in the ice had been such, between the time of our upward trip and the return of my two men from the canal, that they, experienced men that they were in all that pertains to ice-craft, had been hopelessly bewildered, and wandered apparently for at least a day without finding the trail. After their passage other changes had taken place, and as a result I set a compass course for the land, and began making a new road. In the next march we picked up our old trail again.

Early in the morning of the 22nd we reached the second igloo out from Cape Hecla, and camped in a driving snowstorm. At this igloo we were stormbound during the 27th and 28th, getting away on the 29th in the densest fog, and bent on butting our way in a "bee"-line compass

course for the land. Floundering through the deep snow and ice, saved from unpleasant falls only by the forewarning of the dogs, we reached Crozier Island after a long and weary march. The band of young ice along the shore had disappeared, crushed up into confused ridges and mounds of irregular blocks.

The floe at the island camp had split in two, the crack passing through our igloo, the halves of which stared at each other across the chasm. This march finished two of my dogs, and three or four more were apparently on their last legs. We did not know how tired we were until we reached the island. The warm foggy weather, and the last march together, dropped our physical barometer several degrees.

As we now had light sledges, I risked the short cut across the base of Fieldin Peninsula, and camped that night under the lee of View Point. Four more marches carried us to Conger, where we remained three days drying clothing and repairing sledges, and giving the dogs a much-needed rest. Leaving Conger on the 6th of May, eleven marches brought us back to Payer Harbour on the 17th of May. A few days after this I went north to complete the survey of the inner portions of Dobbin Bay, being absent from headquarters some ten days. Open water vetoing a trip which I had planned for June up Buchanan Bay and across to the west coast of Ellesmere Land, the remainder of the time was devoted to assiduous hunting, in order to secure a supply of meat for the winter in the contingency of no ship arriving.

On the 5th of August the new *Windward* sent north by the Club, and bringing to me Mrs. Peary and my little girl, steamed into the harbour. As soon as people and supplies could be hurried aboard her, she steamed across the Sound to the Greenland side. Here my faithful Eskimos were landed, and after devoting a week or so to the work of securing sufficient walrus to carry them in comfort through the winter, the *Windward* steamed southward, and after an uneventful voyage arrived at Sydney, C. B., on the 17th of September, where I had the pleasure of meeting Secretary Bridgman of the Club, and forwarding through him a brief report of my movements during the past year.

THE MAPPING OF INDIA.

In scientific circles in India and elsewhere considerable dissatisfaction exists with regard to the mapping of the Indian Empire, and the Indian Government is being pressed to bring its Survey Department work more into line with modern requirements. We are favoured by an Indian correspondent with the following article, which originally appeared in the *Pioneer*, and will be read with attention by all interested in the cartography of India.

While all around us in India, generally speaking, we see progress, it is a matter for regret that many of the maps of this country are far from what they should be, and the original accuracy of a large number shows

marked signs of deterioration. The announcement at last made in a somewhat belated Government resolution on the annual Report of the Survey of India for 1901-2 that the necessity for effectively revising and keeping up to date the maps now in existence, as well as of providing fresh ones, has at last been forced upon the Government of India, should come as a consolation to many. We can only hope that there may be no half measures, and that the reform may be thorough, for assuredly the need is more crying than most can have any idea of. The initial steps of the survey of this vast Empire were marked by such enterprise, devotion, and ability as have made them a model for the imitation of the world, and it is therefore the more to be regretted that the results of such labour should be allowed to crumble away from neglect, especially as a moderate expenditure and reasonable arrangements would even now save much of the work done. The stern necessities of war have made reliable maps a *sine qui non* for every civilised country on the continent of Europe. In England, which has been spared the ravages of war, public opinion has compelled the Government to take steps for the upkeep of maps which were drifting to decay much as our Indian ones are doing now. India can no longer afford to lag behind in this respect. A possible defect in our Indian administration is that it is largely in the hands of one ruling class, and once the requirements of this body of officials are satisfied the necessity for further exertions is apt to be lost sight of. The old system worked well in the past, when the necessities of the civilian's position compelled him to be a jack of all trades, to concentrate all the strings of his district in his own hand, and to have the final say in all matters. But this is an age of specialists, and the machinery of twenty years ago is hopelessly out of date in the light of modern requirements. To the ordinary civilian a map showing the village boundaries required for revenue purposes is all that seems necessary, and, as there is little change in these as years roll on amid a multitude of other interests, all has doubtless seemed well to those intrusted with the arrangement of survey programmes. But as railways more and more extend over the land, and business men are publishing their projects and sinking their capital in the districts, the need for up-to-date accurate maps becomes more and more acute. The supply at present is ludicrously unequal to the demand. As an instance, take the coalfields of Bengal. In this part of India, what maps there are are utterly out of date; and of several large areas we are informed, in reply to inquiries made, that even obsolete maps are not available, the stones on which they were originally drawn having been worn out or destroyed. The curious thing is that this fate of all things mundane was not foreseen, and some attempt made to replace them in time. We can only conclude that the Survey authorities are well aware that they have no material worth the labour and expense of republishing, and have been hoping against hope that new surveys might be ordered, but meantime the public have to do without maps. What maps there are available are in curiously detached, apparently meaningless, fragments, styled main circuit maps, requiring considerable ingenuity to join them up together. The name of the genius who invented this style of cartographic puzzle

possibly deserves to be perpetuated, though we cannot wish as well for his productions, which, probably ample for the wants of his time, but now wanting in roads, railways, etc., in fact everything that makes a map desirable, are a disgrace to any civilised country. Even from the frontier districts, where reliable information is surely a crying need for military purposes, we hear the same wail of maps utterly antiquated where they are not actually misleading and wrong, and the same may be said of the maps all over India, where the professional work has been long completed. Over much of India, if we require maps of any particular area, as often as not we are supplied with several sheets, each containing a small portion of the tract required, with large blank spaces. It should not be a superhuman task, and one which should tend to economy, to join up by some of the numerous reproducing processes now available all such fragmentary maps into one conveniently-sized sheet which could be easily manipulated. Maps by districts may be all very well for revenue purposes, but are distinctly inconvenient for general use.

We have had occasion lately to require three sheets of country in certain Provinces and Bengal. Of one we were informed that nothing except on a very small scale was available, the Survey records having been destroyed during the Mutiny only half a century ago, and this is ground round an important railway centre. Of the others, two antiquated, blurred, and illegible sheets were supplied. A footnote on each informs the purchaser that these valuable apologies for maps had been photographed from lithographed prints—apparently from very moribund stones—and indeed had it been added that one was the result of the reproduction of a papyrus original extracted from a tomb of the Pharaohs, from its old-world look there would have been little reason to doubt the fact. A further note informed us that for all modern information, such as roads and railways, the Survey Department was not responsible, and one can well understand the desire to disavow these additions, as several were manifestly quite inaccurate. We have made some inquiries as to how these valuable additions to our Indian maps are obtained, and the procedure is thus described. Prior to the republication of one of these antiquated sheets, proofs are sent round to the local Civil and Public Works officials, with the request that any corrections locally available may be noted. One can imagine the rapture with which such work of another department is welcomed by most of the already overworked officials who receive it. We can also realise the alacrity with which the uncongenial work is made over to the nearest unemployed babu to carry out as best he may. Even if he perform his work intelligently, the material he is as a rule asked to insert can at best be the result of prismatic compass surveys—even when new an erratic and uncertain instrument—or, still worse, the results of some of the extraordinary methods of survey which have of late years been perpetrated by various local governments. It is rubbish such as this that unskilled workmen are yearly adding to originally scientifically surveyed sheets, many of which no doubt are past praying for. Verily, we as a nation do things in an extraordinary way. After spending lakhs on maps prepared by men scientifically trained for the job, we call in a ten-rupee clerk to add

to them, and solemnly style it bringing them up to date! Not unnaturally, it appears that much difficulty is often experienced in reconciling these travesties of survey, for widely different representations of identical features are continually being received from officials in the same district. In a published report of a few years ago we can recall that the then Surveyor-General gave a detailed account of the mapping all over India, and emphatically stated that, unless effective measures for the upkeep of maps were at once adopted, a resurvey of most would be imperative, much being already beyond hope; and it is a matter for regret that so many years have been allowed to pass before the official mind could bring itself to accept such an authoritative warning. Bearing in mind that many of the surveys now furnishing our only maps are from fifty to eighty years old, and that during all this time nothing in the way of scientific revision has been done upon them, he must be a very acute mortal who can say what on any single sheet is good and what is bad material, after the patching and adding to from all sources to which they have been subjected. Any system of revision which may be adopted will, we may at once admit, cost much money, for it is not work that can be intrusted to any but skilled surveyors; but it will be cheap compared to the lakhs which must in time be spent on resurveys if the present system of ruining once good maps be not utterly swept away. More of the trigonometrically fixed marks must be religiously preserved all over India as a preliminary measure. With these and a sufficient staff in each Province, as professional opinion may deem necessary, devoted entirely to revision work, we should in time get up-to-date maps, at all events, in districts of which the maps are not past redemption. The pity is, we believe, that the skilled surveyors are not available, thanks to the starvation policy which has been pursued in the past. Men suitable for the work cannot be available until after some years of training. Local governments must have no control over this staff, or else in a year or two their energies will assuredly be diverted to inquiries as to whether Ram Das has trenched upon his neighbour's fields, and the like. Intimation of the opening of any railway or other public work, fluvial changes, etc., would be given by the local authorities, and the staff would at once proceed to accurately map these. Arrangements must also be made which will ensure that the area falling within each sheet shall be gone over and be thoroughly professionally revised once in every ten or fifteen years. Thus there would be one body responsible instead of many as at present, and there might be hope of obtaining within a reasonable time revised accurate maps. And above all, it is to be hoped that, once and for all, Government may sternly discountenance all the non-professional so-called surveys, which, perpetrated by officials with more zeal than discretion and with only a mere smattering of knowledge, are now, where they are not utterly useless, the despair of professional men who are expected to make something of them. The money squandered on these, properly applied, might probably have gone far towards providing us with reliable maps to-day. Professional advice must be freely invited, and, still more important, followed when given.

It will be noticed with satisfaction that the Government has at last come to the conclusion that it is impossible from one centre to keep up to date, and issue, the maps of a vast Empire, as well as meet the innumerable demands of the various Government offices for work which private firms would undertake in Europe. The marvel is that so long has been taken to come to this conclusion, while the public are crying for maps which remain unpublished for years after the survey has been completed. Meantime some official has the satisfaction of seeing some highly coloured maps adorning some report of possibly a purely ephemeral interest, and has not an idea of the consequences attending their production or of the labour spent in obtaining them. There are, we know, grave objections attending on decentralisation, but to over-centralisation there are assuredly many more. Is it common sense to expect that the maps of a country the size of Europe, excluding Russia, can be dealt with from any one centre? Could even the well-ordered maps of Europe be dealt with, say from Paris? There it would strike one as eminently absurd; out here, with a far less reliable *personnel*, no one in authority has thought it so. At home the post-offices are depôts from whence the maps of the surrounding countries can usually be obtained, and though it is probably impossible to follow this lead out here, efficient provincial distribution centres should be at once established.

While accurate maps are the first desideratum, their appearance should not be neglected. With such an enormous area to deal with, rough and ready processes must be adopted for the reproduction of most of the sheets. But we still think that more pains, which probably means money in the shape of more highly skilled labour, should be taken to secure better results in the appearance of our principal maps. The engraved sheets of the Atlas of India and some few other engraved maps will bear comparison with those of any nation, but we understand a skilled European staff is largely responsible for these. But with the various lithographic processes more might, we think, be attempted. At the same time it should be remembered that in tropical lands such as this, where the dimensions of paper alter hourly as the atmospheric conditions vary, colour printing difficulties have to be surmounted such as the printer in more favoured lands has no idea of.

The want of reliable maps has cost us dear of late in South Africa, and though we understand that the mapping of our trans-frontier districts, where military operations are most likely, is in a more satisfactory state, it should not be forgotten that half a century ago fanaticism and prejudice suddenly plunged the whole land into war, and who can say this may not happen again? But apart from this possibility, the increasing needs of the public imperatively demand that the "prehistoric peeps," which now do duty for maps over much of India, shall be replaced by something much better and more up to date, and that better facilities for obtaining them shall be provided.

CORRESPONDENCE.

MAP OF GERMAN SOUTH-EAST AFRICA.

EDITOR OF *Scottish Geographical Magazine.*

EDINBURGH, *October* 26, 1903.

DEAR SIR,—In the Supplement to the *Board of Trade Journal* for October 15, 1903, appears a map of German East Africa. This map bears that it was "prepared at the Intell. Div., War Office, October 1903."

It is not a little surprising, therefore, to note on it four omissions:—(1) The outflow of the Nile from Victoria Nyanza; (2) The outflow of the Lukuga from Tanganyika; (3) The railway inland from Beira; and (4) The railway between Bulawayo and Salisbury.—Yours faithfully,

C. G. CASH.

GEOGRAPHICAL NOTES.

EUROPE.

Trade of the Port of Liverpool.—In a publication issued in October 1903, Mr. Norman Hill, Solicitor to the Steamship Owners' Association, Liverpool, states that the population of Liverpool in 1845 did not exceed 350,000, and in 1902 it was 716,000. In 1845 the city's ratable value was £984,604, and in 1902 it was £4,305,767. Since 1845 the Harbour Authority has expended upwards of £20,000,000 on the extension of the Port. In 1845 the vessels registered in Liverpool were of 368,707 tons, and in 1902 of 2,515,333 tons. The tonnage owned in Liverpool exceeds by more than half a million the tonnage of the German Empire; exceeds by a million the tonnage owned by Norway; exceeds by a million and a half the tonnage owned by France; and is nearly three times the oversea tonnage owned by the United States of America.

During the last ten years the imports into the Port of Liverpool were of the total value of £1,098,000,000; the exports from it were £961,000,000; together £2,059,000,000. The annual average was:—Imports, £109,800,000; Exports, £96,100,000; together, £205,900,000.

The annual average tonnage entered and cleared at Liverpool from and to foreign countries was 9,450,000 tons; and to British possessions, 1,980,000 tons; together, 11,430,000 tons. Of the vessels that entered or cleared from the Port, 82 per cent. traded to foreign countries, and 18 per cent. to British possessions. The total entrances and clearances increased from 9,800,000 tons in 1893 to 13,100,000 tons in 1902. Of the tonnage so entered and cleared, on the average 9,950,000 tons were British, and 1,480,000 foreign owned. The proportion of the total trade carried in British ships has throughout the ten years (1893-1902) been steadily increasing, while that carried in foreign ships has steadily decreased. As percentages, the proportion carried by British ships has increased from 85 per cent. in 1893 to 89 per cent. in 1902, while that carried in foreign ships has diminished from 15 per cent. in 1893 to 11 per cent. in 1902.

Internal Navigation of Italy.—The *Rivista Geografica Italiana* for August has an article by Professor Marinelli on the subject, so important to Italian trade, of

the internal navigation of the country. The principal canal system lies in the region watered by the Po and its affluents, and this and the lower valleys of the Arno and the Tiber are the only instances of naturally navigable waters. In a short historical sketch the author traces the effects, social, political, and commercial, of the changes, natural and artificial, of the main watercourses. It is not a record of uninterrupted progress, for the supreme importance of the waterways leads sometimes to the neglect of the interests of irrigation. It is intended to connect the waterways of the plain of the Po with the north Italian lakes, Maggiore and Como being already thus connected.

ASIA.

Climate of the Philippines.—In the *Bulletin of the American Geographical Society* for June, Mr. Walter S. Tower gives some notes on the climate of the Philippines, based on observations made at Manila from 1885 to 1898. The climate may be summarised as follows: High temperature throughout the year; small annual and relatively small diurnal ranges; humid, with excessive rainfalls at times; at certain seasons violent tropical storms. There is a wet season from June to October, and a dry season from November to May, but this does not imply that the dry season is absolutely without rain, nor that there is a continual downpour in the rainy season. There is a minimum of rain in the months from January to April, with the absolute minimum in February, and there is a maximum of rain in July, August, and September, with the absolute maximum in the last month. The north-east trade-wind blows during the greater part of the year, the so-called south-west monsoon being felt during the four summer months—June, July, August, and September—while May and November have variable winds. The typhoons often cause much damage along the low-lying coasts, and a great deal of careful work has therefore been done at the Manila Observatory, in order to bring the prediction of these storms to the greatest possible degree of accuracy. With this object the Director of the Observatory has invented a so-called baro-cyclonometer, an ingenious association of an aneroid barometer and a cyclonometer. Between 1880 and 1898, 397 typhoons passed near enough to the Observatory at Manila to make their influence felt there, February being the only month in which none occurred. The "tornadoes" of the Philippines are not the same phenomena as the well-known western storms of the same name in America, but are like ordinary thunderstorms. A yearly average of 505 occurred at Manila during the ten years from 1888 to 1897. In December, January, and February the Philippines climate is at its best, the temperature and the humidity both being low, the rainfall light, the nights cool, and storms least frequent. During the remainder of the year, the conditions of heat, humidity, heavy rains, and the greater prevalence of contagious diseases are undoubtedly very trying for North Americans, and probably few will settle permanently in the Philippines.

The Census in the Philippines.—It is announced that the United States military authorities have recently completed the work of taking the census in the Philippine Islands, and that the schedules and all the data, so far as collected, have been sent to Washington for compilation and publication under the supervision of the Census Bureau. This course has been followed because of the facilities for machine tabulation, by the use of which it is hoped to have the complete returns issued within a year from this time. However, a rough count from the schedules shows a total population of 6,976,574, being considerably short of the estimates hitherto made, these varying from eight to ten millions. Of these the preliminary returns indicate that about 650,000 belong to the wild tribes. The preliminary

examination shows that the results, regarded as a whole, may be taken as a success, under somewhat discouraging conditions, of the application of American census methods to entirely different population problems. In the execution of the work there were employed 56 supervisors, each with a clerk and messenger, 998 special agents, 61 special enumerators, and 5892 enumerators, working in an equal number of districts. In about five provinces difficulties were experienced from bands of ladrones. In four instances the enumerators were held up, but only in one case were the schedules molested. In three districts on the island of Cebu some opposition was manifested to the taking of the census, owing to the old idea that its object was taxation. The opposition did not prove serious, and was completely removed as soon as the proclamation of the civil governor avowing the purpose of the census had been carefully explained. Therefore, considering the novelty of the procedure as compared with the census methods previously employed in the Philippines, the complex nature of the instructions, imparted in a foreign language to the various officials, and the necessity for relying upon the telegraph for the explanation of difficulties as they arose from time to time, the military authorities believe they have been successful in procuring results that will be even more accurate and valuable than those recently achieved in Puerto Rico.

AFRICA.

Macmillan Expedition to Blue Nile.—Some particulars are now available in regard to this expedition, whose failure had been previously announced. Mr. Macmillan states that the failure was entirely due to the unsuitability of the boats employed. The boats were put together at Kutia, and consisted of four steel punts, two of which were wrecked during the first day's navigation, and in consequence the expedition was compelled to return to Addis Abeba. Mr. Macmillan, however, proposes to renew the attempt to navigate the Blue Nile during the present year, utilising his experience in the construction of boats of a more suitable type.

AMERICA.

Climate and Vegetation of Guatemala.—In the *Bulletin of the American Geographical Society* for June, Dr. Gustav Eisen gives some interesting notes on a journey in Guatemala, which occupied from March to December 1902. Guatemala may be said to belong to the "Moist Tropical Zone." Its climatic conditions depend not only upon its situation but upon the height and extent of the mountain regions. The main feature which distinguishes Central America from Mexico is that the rainfall of the former is greater and more evenly distributed, owing to its originating from two distinct sources at the same time, the Pacific Ocean and the Caribbean Sea. The humidity of the air in Guatemala is thus very great, but differs in different localities, being greater as a rule in the mountain region and in the low coast belt than in the interior valleys. The northern mountain region is also much more humid than the southern, and the Atlantic coast more moist than the Pacific, while everywhere the humidity of the air is much greater in the forests than in the open country. Three more or less distinct zones of precipitation may be distinguished, but as a rule the rainy season lasts between April and November, the remaining months being those in which the least rain falls.

As regards temperature there are two maxima and two minima annually, the former occurring in April-May and August, and the latter in July and December-January. The mean temperature in the City of Guatemala is, indoors, 74° F. and out of doors, 66°. In the sun it seldom reaches 86°. The frost-line of the

Pacific slope coincides with a line at an altitude of about 4000 feet. This line marks the limit for the cultivation of the coffee-tree, and to some extent, for the profitable production of sugar-cane. Except for the narrow coast belt, the temperature is comfortable and agreeable both winter and summer. Thunderstorms are characteristic of all parts of Guatemala, and the interesting phenomenon of "circular lightning" was often observed during the visit.

As regards vegetation, the variety and extent of the different vegetable zones are not only scientifically very interesting, but of great economical importance.

The Littoral Saline Zone has also received the name of "mangrove swamps," but where the ground rises above these swamps, the mangroves are replaced by dense forests, in which cocoa palms and other tropical plants may be cultivated to a limited extent. With this exception the zone is unsuited to cultivation.

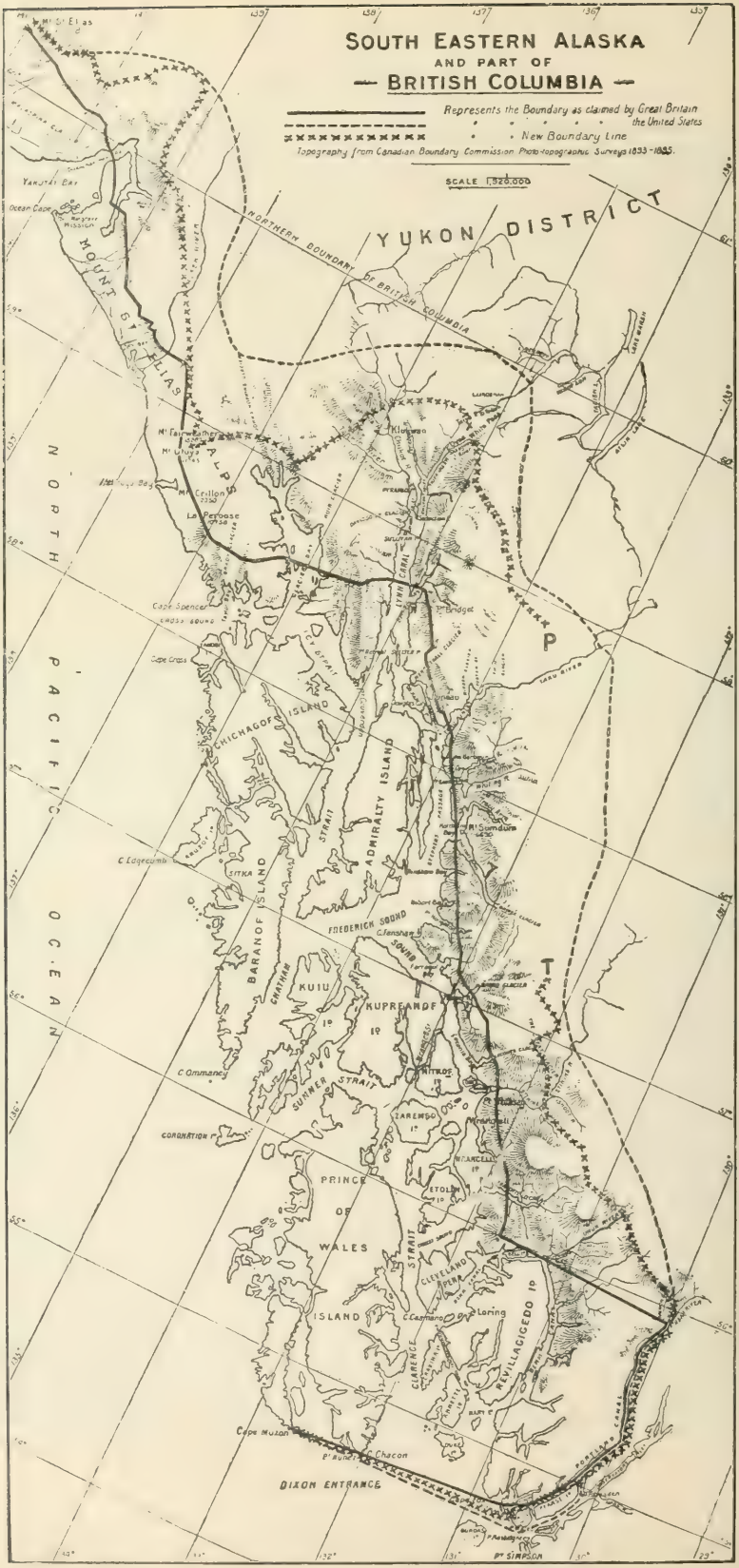
The Humid and Warm Arboreal Zone, met with on the higher ground, contains impenetrable forests of majestic tropical trees in great variety. These trees are dicotyledonous and evergreen, and many are of great height. The denseness of the forests is due principally to the impenetrable growth of various kinds of parasitic plants with which nearly all the trees are covered. These magnificent forests are however rapidly disappearing. In many places they have been cut and burnt, and succeeded by sugar or coffee plantations or pasturing grounds for cattle.

The Temperate Arboreal Zone occupies the interior of Guatemala from the crest of the Pacific coast cordillera to the humid region of the north and east. The characteristic vegetation here is open forests of evergreen oak and of pine, but to a large extent these have long ago been cut down, and fields of maize and beans have taken their place. It is interesting to notice that these two last-named zones interlace with each other in the High Sierras, occupying the same altitude side by side. The most plausible explanation seems to be that owing to the configuration of the mountains, a certain regularity in the air currents has been established in such a manner that the cold currents always follow the same routes. Upon reaching the cold currents the moisture in the air condenses in the form of clouds, which keep the vegetation green and luxuriant all the year round. The fact of a difference in the soil, that in the humid zone being deep, black, and wet, while that in the pine zone is dry, shallow, and of chocolate colour, indicates that similar conditions have existed from time immemorial, perhaps from the beginning of the Tertiary period. The rock formation of limestone bed rock is similar throughout.

The Humid and Cold Arboreal Zone occupies the high valleys of the northern sierra, as well as some of the upper slopes of the volcanoes. Its greatest altitude is about 12,000 feet, and its lowest 7000 to 8000 in some localities, though several thousand feet higher in others. The trees here are gigantic and magnificent cedars, vines, and cypress trees, with a dense undergrowth, so that the whole forms impenetrable masses of verdure. The clouds hang over these forests throughout the year, and the condensed fogs, during certain hours of the day, drip to the soil in an almost constant rain.

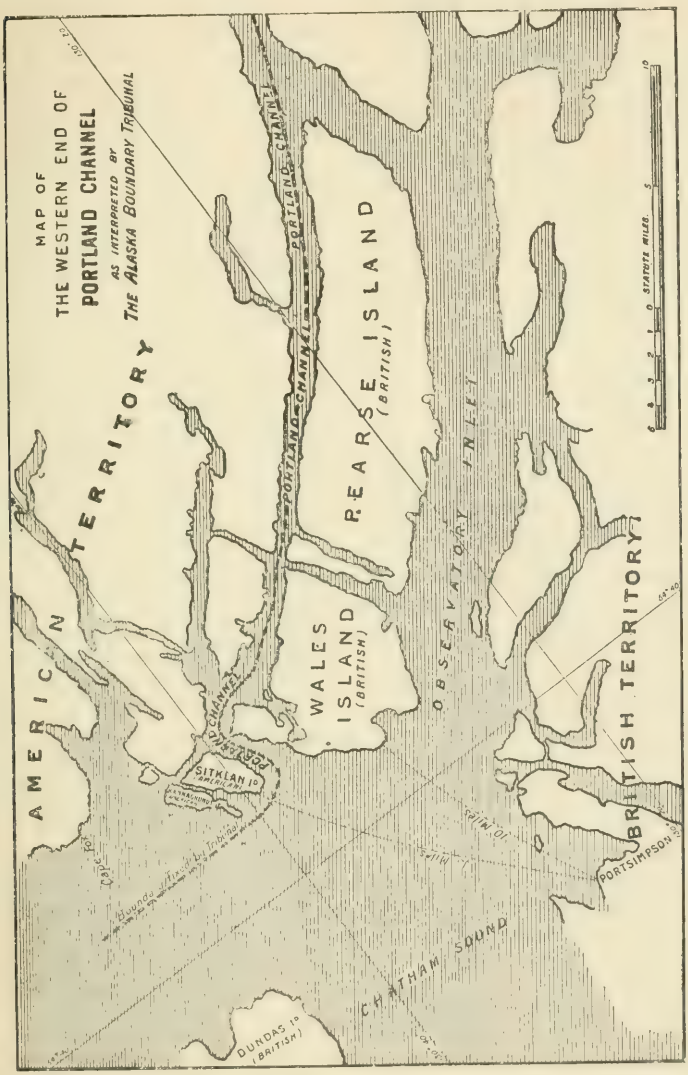
The Dry and Warm Zone occupies certain valleys in the central part of Guatemala, and produces deciduous trees of small growth and dense thickets of thorny bushes, the open places being characterised by desert types, such as the cactus. Except corn, no crops can be profitably grown here without irrigation, but the cocoa palm, the sugar cane, and other tropical plants flourish. During the dry months there is a magnificent floral display, furnishing a rich harvest to the botanist.

The Savannas, a zone occupying a very limited territory in the high sierra and


SOUTH EASTERN ALASKA
AND PART OF
BRITISH COLUMBIA
Represents the Boundary as claimed by Great Britain
the United States
New Boundary Line
Topography from Canadian Boundary Commission Photo-topographic Surveys 1933-1935.
SCALE 1:250,000
YUKON DISTRICT
NORTHERN BOUNDARY OF BRITISH COLUMBIA
MOUNT ST. ELIAS
ALPS
NORTH PACIFIC OCEAN
Yakutat Bay
Ocean Cape
Mt. St. Elias
Mt. Fairweather
Mt. Crillon
La Perouse
Glacier Bay
Klukwan
Dyea
Skagway
Lake Bennett
Lake Tagish
Atlin Lake
Telegraph Creek
Dease Lake
Stikine River
Iskut River
Bronson Creek
Cape Spencer
Lynn Canal
Chilkoot Pass
Chilkat River
Cape Cross
Icy Strait
Glacier Bay
Chichagof Island
Admiralty Island
Juneau
Douglas
Gastineau Channel
Taku River
Sumdum
Sumdum Glacier
C. Edgecumbe
Sitka
Baranof Island
Frederick Sound
C. Fanshaw
Duncan Canal
Wrangell
Stikine River
Kuiu I.
Kupreanof I.
Kupreanof
C. Ommaney
Summer Strait
Petersburg
Mitkof I.
Zarembo I.
Coronation I.
Prince of Wales Island
Kanagunut
Etolin I.
Wrangell I.
Cleveland Peninsula
Clarence Strait
Loring
Revillagigedo I.
Cape Muzon
Dixon Entrance
Chacon
Pt. Simpson
Boundary
Ketchikan

on the upper part of the volcanoes, produce few or no trees, but often an abundance of bunch-grass. The only Barren Zones in Guatemala are the very summits of some of the volcanoes where the ejected sand and ashes have formed steep cones. Outside of these few places every inch of land in Guatemala is covered with vegetation of some kind, and generally by one of great luxuriance.

Alaskan Boundary Award.—We reproduce this month two sketch maps showing



the line of demarcation between British and American territory as determined by the Alaska Boundary Tribunal, whose decision was made on October 20 of the present year. By this decision the boundary line is stated to begin at Cape

Muzon, and Portland Channel is decided to be the channel which runs from about 55° 56′ north lat., passes to the north of Pearse and Wales Islands, and subsequently separates Wales Island from Sitklan Island. This part of the decision is illustrated by the smaller map, and it will be seen that its result is to give Wales and Pearse Islands to Britain, and Sitklan and Kannaghunut Islands to the United States. This map also shows the position relative to these islands of Port Simpson, the proposed terminus of the new transcontinental railway. The larger map shows the course taken by the line from its point of origin at Cape Muzon to the entrance of the Portland Channel. From the head of the Channel the line takes the course indicated to a point on the 56th parallel of latitude. From this point the line extends northward, following the crest of the mountains situated parallel to the coast until its intersection with the 141st degree of longitude west of Greenwich, subject to the condition that if such line should anywhere exceed the distance of ten marine leagues from the ocean, then the boundary between British and American territory should be formed by a line parallel to the sinuosities of the coast, and distant from it not more than ten marine leagues, thus giving to America a continuous strip of coast on the mainland, separating the British possessions from the bays, ports, inlets, havens, and waters of the ocean, and extending from the point named above on the 56th degree of latitude to the point where the line intersects the 141st degree of longitude west of Greenwich. As regards the mountains of which mention is made in the above article of the award, the commissioners have decided that between the points marked T and P on the larger map the survey which has been made of the country is insufficient to determine the range intended, and therefore in this region the boundary line cannot be laid down on the map, though it is determined theoretically by the above article. For a discussion of the whole question of the Alaskan Boundary, reference should be made to an article by Mr. Alexander Begg in this *Magazine*, vol. xvii. p. 30.

Centenary of British Guiana.—This colony has been recently celebrating the centenary of its cession to the British, which occurred in 1803. A recent mail has brought local newspapers which summarise the history of the hundred years of the colony's existence. The most important incident during this period was the final emancipation of the slaves in 1838, which being done without regard to the economic conditions prevailing at the time, led to widespread commercial depression. This state of affairs was slowly remedied by the importation of labour, and in 1865 the colony was in a prosperous condition. In 1883, owing to the sugar bounties, another crisis supervened, from which the colony is now beginning to recover. At present its prospects are said to be encouraging, if not brilliant.

Swedish Scientific Expedition to South America.—A Reuter telegram from Stockholm states that Baron E. Nordenskiöld has arranged to make a zoological and anthropological expedition to the frontiers of Peru and Bolivia. The expedition will start at the end of December or the beginning of January.

AUSTRALASIA.

Ethnography of North Queensland.—In Bulletin 5, Mr. Walter G. Roth gives some interesting details in regard to the superstition, magic, and medicine of the aboriginals of North Queensland. Under the head of superstition are given a number of myths connected with the sun and moon, and such natural phenomena as thunder, lightning, the rainbow, and so forth. At Cape Bedford the moon

is the husband of the sun, and at new moon he is starving, while the full moon is the result of a successful fishing expedition, by means of which he has become gorged. There are really two suns, who are sisters; in the hot season it is the elder sister who appears, and in the cold the younger. Staring at the moon for a long time causes heavy rain to fall, while in the case of children pointing at it with the fingers straight will cause the death of the parents. Rain is manufactured by special individuals, and as among other primitive races imitative actions with water usually play an important part in the various methods adopted. In one very interesting and characteristic performance, a mimic water-hole is constructed and the men dance round it, imitating the sounds and motions of aquatic animals (*e.g.* frogs and ducks). Later they throw crushed quartz crystal ("rain stone") over the women, who pretend to be protecting themselves with pieces of bark and so forth from a heavy rain. As a matter of fact, it is observed that rain usually follows the "rain-making," but the ceremonies are only practised at those seasons of the year when rain is likely to fall, and only by experienced individuals who are probably aware of the atmospheric conditions which precede its fall.

The natives generally believe in a vital principle or soul, sometimes regarded as also present in dogs. On the Tully river this soul is called Koi in the male, and Ku-inggan in the female, and is associated both with the breath and the shadow. It is described as having "no bones" and persists after death, when it may do harm to a black found alone, but not to a group of individuals. On this account the blacks have continually impressed upon them from childhood the dangers of solitude. The only defence from Koi is a good fire. Among the other tribes there are slight variations in the characteristics of these spirits. The ear is believed to be the seat of intelligence by the North Queensland blacks generally. An interesting illustration of this is furnished by an anecdote of an early settler who was in the habit of sending written messages to his son by his black servants. When the blacks saw that the message was understood, they first examined the paper or board in which the message was written with great care, and finally put it to their ears to see if they could hear anything. Similarly in gesture language, loss of memory is indicated by plucking at the ear with thumb and forefinger, the idea being to pull out something which was originally placed in the ear.

Disease and accidents are due to one of two causes—(1) to an enemy who has doomed the victim, or (2) to violation of "tabu" by the individual. In the latter case, the offence may be the eating of forbidden articles of food, certain crimes (*e.g.* rape), or the neglect of certain rules of conduct (*e.g.* wandering alone in the bush). In these cases recourse is had to certain charms, and to the very primitive medicine and surgery of the tribes. If the illness be prolonged, and these measures produce no obvious effect, then it is concluded that the condition of the patient is due to his having been doomed. He then takes various steps to discover his assailant, and finally calls in the aid of the medicine-men. If the charms of the latter prove useless, the patient gives up hope, and may deliberately lie down and die. Mr. Roth has personally seen some five or six cases of this, one of the most curious being that of a fairly well educated half-caste. In another case, a black servant prophesied his own death in three days, and died on the day indicated. The doom may be inflicted by an enemy with or without the aid of spirits, or by spirits independently. The medicine-men are exclusively concerned with the production or cure of disease by charms, etc. They are not in any sense doctors, for the medical knowledge of the tribe, such as it is, is common to all its members, and the sick are attended to by their nearest relatives. The native pharmacopœia includes a considerable number of plants, as well as certain animal preparations.

The Continental Origin of Fiji.—Mr. W. G. Woolnough read a paper on this subject before the Linnean Society of New South Wales on June 24. The author's provisional conclusions are as follows:—(1) That Viti Levu, the chief island of the Fiji group, was part of a continental area probably united to New Hebrides and New Caledonia during early Palæozoic time, and that it remained a land area undergoing denudation probably to at least the close of Palæozoic time. (2) That in Mesozoic time and Older Tertiary time subsidence predominated in the Fiji area, the subsidence at Drau, in Viti Levu, carrying the island at least 1300 feet further below the sea than it is at present. During this period the Fiji Soapstone was deposited. (3) In late Cainozoic time elevation set in, and synchronously with it occurred violent and extensive eruptions of andesitic dolerite and basalt. Elevation has continued into late Cainozoic time, and may still be in progress. On the whole, therefore, negative movement of the land has probably greatly predominated over positive movement since Palæozoic times.

Climate and Soil of the Samoa Islands.—From the *Bulletin de la Société d'Études Coloniales* we extract the following notes on the Samoan islands, made by Mr. Vohltmann, who has been sent there on a scientific mission. The climate is not well suited to Europeans, for although manual labour is possible to whites during a part of the day, yet a distinct loss of efficiency is observable, and prolonged sojourn in the islands is impossible without occasional visits to a cooler region. The island of Upolu shows all the general characters of the Pacific islands. It is covered with verdure, but despite the climate and soil there are no dense or well-grown forests. Careful investigation shows that this is not the result of natural conditions, but of the fact that the island has at some former period been more densely populated and more intensely cultivated than at present. In the midst of the forest ruins of villages can be made out, and there are also traces of numerous boundary walls. In consequence the soil is not virgin, but is deficient especially in salts of potassium, while much of the forest is of quite recent growth. The soil is varied in character: it is usually stony, so porous that the streams tend to disappear wherever the slope of their bed is slight, and excessively rich in iron, while poor in lime and potass. In consequence the cultivation of cacao is fraught with many difficulties, and is not susceptible of the extension which was expected. Some of the difficulties may be overcome by scientific treatment, but the island will never become an important centre of cacao cultivation, and the results meantime are very disappointing.

POLAR.

The Antarctic Relief Expeditions.—The *Terra Nova*, the second relief ship of the National Antarctic Expedition arrived at Hobart, Tasmania, at the end of October. She made a splendid passage of sixty-five days, but, as already indicated, she was towed by warships as far as Sokotra. Afterwards she steamed and sailed at an average rate of five knots an hour. Fine weather was experienced during the voyage, except off Cape Leeuwin, where heavy gales were met with, the decks being continuously flooded, and a boat smashed. The boat, however, proved very seaworthy. The *Morning* arrived at Hobart a few days after the *Terra Nova*, having experienced very rough weather on her journey from Lyttelton. It is expected that the two ships will leave together about the beginning of December to start their long journey southward to the *Discovery's* quarters in M'Murdo Bay.

The Argentine gunboat *Uruguay* arrived at Rio Gallegos on November 23 with the members of the Swedish Antarctic Expedition on board

GENERAL.

Earth Noises.—The *Bollettino* of the Italian Geographical Society has a paper dealing fully with the mysterious sounds heard in many different localities, and which naturally give rise to a crop of legends, such as that of the Fingalian harps in the cave at Staffa. The writer refers them to various causes, as, *e.g.* earth tremors, forests, moving sands, the generation of gases and currents of air, but perhaps chiefly to the action of subterranean waters. The special forms and angles of the rocks inclosing certain valleys also, it is said, account for a good deal. At Otres in Dalmatia the conditions seem at first sight exceptionally curious, for the sounds are only heard at night, and only in the spring of the year, but the former circumstance, the writer thinks, is due simply to the absence of other noises at night, and the latter to the amount of water passing in spring through certain underground channels.

International Congress of Americanists.—We have received an intimation to the effect that the Fourteenth International Congress of Americanists will be held at Stuttgart from August 18 to 23, 1904. The subjects to be discussed by the Congress are: (*a*) the Native Races of America; (*b*) the Monuments and Archæology of America; (*c*) the History of the Discovery and Occupation of the New World. The General Secretary of the Committee of Organisation is Professor Dr. Kurt Lampert, Stuttgart, Archivstrasse 3, to whom communications should be addressed.

COMMERCIAL GEOGRAPHY.

The Trade of Zanzibar.—The tables attached to the report of Mr. Cave, British Consul-General at Zanzibar for last year show that the imports amounted to £1,106,247, and the exports to £1,080,277, the figures in both cases being slightly less than the averages of the previous five years. The decline in imports is due to fewer coins having entered, and of exports to less specie having been sent to other ports, and to a late clove harvest; but "in other respects the general trade of the country shows no sign of deterioration, and there appears no reason to fear that its prosperity is on the wane." India easily takes the first place in the import trade of Zanzibar, her share last year being a little under 30 per cent. of the whole. Indian trade with East Africa, however, does not seem to be carried on, as formerly, wholly through Zanzibar; goods are now shipped direct to Mombasa. Amongst European countries Great Britain takes the first place, and sends about 37 per cent. of all the goods sent to Zanzibar from Europe and America. British imports are now at a higher level than they have been for some years, chiefly owing to larger imports of coal and piece goods. In exports, India, which takes much of the clove crop, stood second last year amongst non-African countries, and France first, by reason of the quantity of copra taken, the positions of the two being usually the reverse of this in the export trade of Zanzibar.

British Central Africa Protectorate.—During the last financial year the trade in this Protectorate practically recovered from the state of depression into which it had fallen during the previous year. This depression was largely due to the failure of the coffee crop, which showed signs of improvement last year. The export of coffee during the twelve months amounted to over £25,000, an increase of about 70 per cent. on the value of that exported in 1901-1902, though still slightly below the figures for the previous year. Coffee is far the largest item in the list of exports, so that the total exports vary with the amount of coffee. The increased exports for last year, as compared with the previous year, is reflected in the amount of imports, which also increased with the increase in the purchasing power

of the inhabitants. Much is expected from the new railway which is being built from the Portuguese frontier on the right bank of the Shire river to Blantyre in the Shire Highlands. The Shire river, which flows into the Zambesi, would afford an excellent means of communication between Lake Nyassa and the sea, were it not for the fact that for some thirty miles its course is obstructed by the Murchison rapids. These rapids cannot be traversed by vessels of any size, and in consequence goods destined for the Protectorate have to be landed at the foot of the rapids, carried up-stream for a considerable number of miles, and then re-shipped. This obstruction has been very much against the development of the trade of the region, and two years ago a railway company was formed to undertake the construction of a line to Blantyre, and ultimately to Lake Nyassa. Meantime a mono-rail tramway has been laid down on the banks of the Shire, but has not been found to answer well on account of the steepness of the gradients, so that the completion of the railway is eagerly awaited.

Railways in French West Africa.—The last report from Captain Cromie, British Consul at Dakar, describes the condition of French Guinea as very satisfactory. The colony has successfully tided over the very severe commercial crisis with which it was threatened. Its products have been improved, and efforts are being made to introduce new ones, business has been placed on a sounder footing, owing to the elimination of weak firms, and there seems no reason, in his opinion, why the colony should not continue to increase in prosperity, especially if the principles of equal trade for all, which have hitherto proved so successful, are adhered to. It remains to be seen what effect upon trade the opening of the railway will have, and whether it will still be possible for firms to transact the greater portion of their business in Konakry itself, or whether they will find themselves obliged to open factories in the interior. On the subject of the Konakry-Niger railway, Captain Cromie mentions that the contractors were relieved of the work last year at their own request. It was then decided that the work should be carried on directly by the colony, and it was intrusted to the military corps of engineers under the direction of the officer who had made all the surveys for the line. By adopting entirely new methods of working, the engineers were able to overcome the labour difficulties which had proved disastrous to the contractors, and very rapid progress was made during the year. If all goes well, it is expected that the first section of 150 kilometres (about 94 miles) to Knidia, near the important post of Friguiagbé will be opened for traffic by the end of the present year. Work will then at once be commenced on the second section to Timbo, the capital of the Fouta Djallon. The line passes through some most picturesque mountain country, clothed with tropical vegetation, and watered by several rivers forming numerous rapids and waterfalls, some of them of considerable size and beauty. The highest point to which the railway will attain is about 2430 feet above the sea. From this culminating point it will gradually descend to the valley of the Niger at Kurussa, between which place and Baunnako (the terminus of the Sudan railway, which will shortly join the head of the navigable portion of the Senegal river at Kayes with the Niger) the Niger is navigable, so that when the railways now in course of construction are completed, there will be uninterrupted communication by rail and river between St. Louis, at the mouth of the Senegal river (and thence by the existing Dakar-St. Louis railway to Dakar, the great port which is being constructed close to Cape Verde), and Konakry. When these railways are all in working order, the commerce of the Sudan and Upper Niger valley will have the choice of the three ports of St. Louis, Dakar, and Konakry, the two former in Senegal and the latter in French Guinea.

The French Indo-China and Yun-nan Railway.—A report recently presented to the shareholders of the railway company of Indo-China and Yun-nan supplies useful information of the great efforts that have been exerted to complete the Indo-China portion of the line from Haifong, the port of Tongking, to Laokai, on the Chinese frontier, and to make the necessary surveys between Laokai and Yun-nansen, the capital of the Chinese province of Yun-nan. Under the terms of an agreement of June 15, 1901, the colony must hand over the Haifong-Laokai line to the railway company fully equipped. Since April 1, 1903, the company has been working the Haifong-Hanoi section of the line (100 kilometres), and from October 1 next will undertake the Hanoi-Vietri section (73 kilometres). At the beginning of 1904 they expect to work the Vietri-Yenbay section, already well advanced, and by April 1, 1905, to take in hand the whole line to Laokai. A contract has been made with a construction company to build the Laokai-Yun-nansen line, for which surveys were begun at Laokai in December 1901. A route preferable to that at first decided upon has now been discovered. It will follow the Naniti Valley, pass through or near the Customs stations of Mengtsze, Amichou, and Posi, toYun-nansen. This route has the advantage of being less costly. It will carry a greater traffic by enabling heavier and faster trains to be run, it will pass near coalmines, and it will afford opportunities for future developments. These include possible branch lines to the provinces of Kevei-chau and Szu-chuan. The negotiations required under the Franco-Chinese treaty of 1898 have been entered upon with China regarding the route of the new line. The surveys have been retarded by several incidents due to the prejudices of the natives against foreigners, but it is hoped that the troubles are now over.

Trade of India with Chinese and Russian Turkestan.—This trade passes mainly through Leh (Zadakh) in Kashmir. Leh is not a central market, but merely a village which chance and geographical position have made a convenient spot for registration. In 1901-2 the total trade between India and Central Asia amounted to £151,000, or twenty-four per cent. more than in 1900-1. The increase was due principally to the large importation and high price of the drug charas in the Indian market, which stimulated an expanded trade in the reverse direction. The imports into British India, £78,300, consisted mostly of charas, raw silk, and gold, while the exports therefrom, £72,900, comprised mainly cotton manufactures, coral, silk piece goods, and indigo. The coral, which is much sought after in Russian Turkestan, comes from Italy, and though a heavy tax of 4·7 roubles per pound is levied on it at Kashgar, the trade has not been diverted to the overland route through Russian territory. The relatively small export of tea *viâ* Leh is partly Indian tea from native gardens round Palampur, partly China tea brought in increasing quantities from Bombay. Indian tea seems unlikely to succeed in Central Asian and Tibetan markets unless an article more closely resembling Chinese brick tea can be supplied. Russian competition with English cotton goods becomes keener every year, as the Russians imitate, and, owing to their favourable situation, easily undersell the English manufactures, which are now restricted to muslins, handkerchiefs, etc., while the Russian factories practically monopolise in Turkestan the trade in chintz. As chintz is the material of the ordinary native clothing the demand for it is very great. The Germans supply velvet and many sundries. Although trade as a whole was better last year, a continuance of prosperity cannot be anticipated, inasmuch as the general activity of trade largely depends on the fluctuating traffic in charas.—*Times.*

Introduction of the Mango into the United States.—According to the *National Geographic Magazine*, the U.S. Department of Agriculture has been recently

studying the mango, with a view to ascertaining whether it could be rendered a popular fruit in the States. Great quantities of mangoes are grown in Porto Rico, and it is thought that if the fruit became popular, a profitable industry might be established in exporting it to the United States, the recent enormous development of the trade in bananas proving how rapidly a new demand may be created. In many parts of the tropics the mango is exceedingly popular, and forms an important part of the food supply, being relished by natives and Europeans alike. A considerable amount of the fruit is exported from India to England, but as yet it is little known in the States. The mangoes which in the meantime reach the markets of the northern States are very inferior in quality, and not likely to increase the demand, but strenuous efforts are now being made to grow the more delicate varieties in Porto Rico, and it is hoped that these may soon be put upon the market. In Florida also the planters are devoting great attention to the fruit, but there the risk of frost is great, the tree proving to be very susceptible to cold. In Porto Rico this danger does not exist, and the dry southern side of the island seems to possess a climate in every way suitable to the development of the mango plantations.

Trade of France.—The report for the year 1902 on the trade of France was issued on 26th October 1903 in the Diplomatic and Consular Series of official Foreign Office publications. From definite statistical tables now available it appears that the gross movement of the trade of France with her colonies and with foreign countries in 1902 is estimated to have reached a total of £451,840,000, imports and exports combined, being an increase of £18,800,000 compared with the previous year, and £20,520,000 compared with the average of the preceding five years. The gross imports amounted to £227,960,000, or an increase of £3,720,000 as compared with the previous year, and £2,640,000 compared with the preceding quinquennial average. The gross exports represented a value of £223,880,000, or an increase of £15,080,000, compared with 1901, and £17,880,000 compared with the five years' average. Under "special commerce," which comprises all goods actually entered for consumption and exports of home produce, imports and exports combined represented a value of £345,848,000, being an increase of £10,560,000 in favour of 1902. Taking imports alone they were £175,760,000, while the exports under this head amounted to £170,088,000. Compared with 1901 this is an increase of £1,000,000 on imports and £9,568,000 on exports. Taking the three great sub-divisions adopted by the French customs, the imports (special commerce) group themselves under the following heads :—

Food products	£32,732,000
Raw materials	111,944,000
Manufactures	31,084,000
Total . .	£175,760,000

Compared with 1901 these figures show an increase in the articles comprised under the first and third heads, viz., food products increased by £1,372,000 and manufactures £204,000, while there is a falling off of £576,000 on raw material. The exports under the same divisions were :—

Food products	£28,296,000
Raw materials	46,808,000
Manufactures	94,984,000
Total . .	£170,088,000

Food products here show a decrease of £1,504,000, raw material an increase of

£6,088,000, and manufactures £4,984,000. Turning to volume, the gross movement of trade, imports and exports combined, under general commerce, reached a total of 40,366,579 metric tons, being 29,138,234 metric tons imports and 11,228,345 metric tons exported.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

The Origin and Growth of the English Colonies and of their System of Government. An introduction to Mr. C. P. Lucas's Historical Geography of the British Colonies. By HUGH E. EGERTON, M.A. With 8 Maps. Crown 8vo. Pp. viii + 224. *Price* 2*s.* 6*d.* Oxford: The Clarendon Press, 1903.

Commercial Geography of the World outside the British Isles. By A. J. HERBERTSON, M.A., Ph.D., F.R.S.E. Post 8vo. Pp. 268. *Price* 2*s.* 6*d.* Edinburgh: W. and R. Chambers, 1903.

Australind: a Narrative of Wanderings in Western Australia and the Malay East. By HENRY TAUNTON. 8vo. Pp. xi + 247. *Price* 10*s.* 6*d. net.* London: Edward Arnold, 1903.

In Russian Turkestan: a Garden of Asia and its People. By ANNETTE M. B. MEAKIN. Crown 8vo. Pp. xvii + 316. *Price* 7*s.* 6*d. net.* London: George Allen, 1903.

The Expansion of Russia, 1815-1900. By FRANCIS HENRY SKRINE, F.S.S. Crown 8vo. With 3 Maps. Pp. viii + 386. *Price* 6*s.* London: C. J. Clay and Sons, 1903.

Botany of the Færöes, based upon Danish Investigations. Part II. published by the aid of the Carlsberg Fund. Copenhagen: Ernst Bojesen, 1903.

Place-Names of Scotland. By JAMES B. JOHNSTON, B.D. Second edition. Pp. cxi + 308. Crown 8vo. *Price* 6*s. net.* Edinburgh: David Douglas, 1903.

Nyasaland under the Foreign Office. By H. L. DUFF. Demy 8vo. Pp. xv + 422. *Price* 12*s. net.* London: George Bell and Sons, 1903.

Geographic Influences in American History. By ALBERT PERRY BRIGHAM, A.M., F.G.S.A. Crown 8vo. Pp. xv + 366. *Price* 6*s.* London and New York: Ginn and Co., 1903.

The Evolution of Earth Structure, with a Theory of Geomorphic Changes. By T. MELLARD READE, F.G.S. 8vo. *Price* 21*s. net.* London: Longmans, Green and Co., 1903.

Also the following Reports, etc.:—

Atlas des Erdmagnetismus für die Epochen, 1600, 1700, 1780, 1842 *und* 1915, von Dr. H. FRITSCH. Riga, 1903.

Administration Report of the Marine Survey of India for the year 1902-1903. Calcutta, 1903.

Extracts from Narrative Reports of the Survey of India for the Season 1900-1901. Prepared under the Direction of Colonel St. G. C. GORE, C.S.I., R.E. Calcutta, 1903.

The Administration of the Lower Provinces of Bengal, during the Lieut.-Governorship of Sir John Woodburn, K.C.S.I. Calcutta, 1903.

Annual Report of the Secretary for Mines and Water Supply to the Hon. E. H. Cameron, M.P., for the Year 1902. Melbourne, Victoria, 1903.

Mines and Mining in Peru. With mineralogic Map. Pp. 39. Lima, 1903.

Publishers forwarding books for review will greatly oblige by marking the price *in clear figures, especially in the case of foreign books.*

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

A Meeting of Council was held on November 19 when the undermentioned ladies and gentlemen were elected Members of the Society :—

Captain Walker, D.S.O.
The Hon. Lord Stormonth Darling.
George Burnett.
Prof. W. R. Hardie.
William Robertson.
J. F. White, LL.D.
Miss Agnes Edmondston.
John Alex. Harrow.
Major Alex. Leonard Duke, M.B., C.M., I.M.S.
Alex. John Lethem.
Miss Mary Spalding Walker, B.A.
Major James Alexander, V.D.
Mrs. E. Lawson Mitchell.
Thomas MacLeod Gardiner.
Miss G. B. Gamble.
Miss M. Reid.
Lieut.-Colonel Campbell.
George Freeland Barbour
James R. Brown.
Miss Julia Cant.
Miss Guthrie Wright.
William Stewart Morton.
Alex. Bruce, M.A., M.D., F.R.C.P.E.
Mrs. I. E. Morison.
Thomas Brash Morison.
Archibald Hewat, F.F.A., F.I.A.
E. J. Young.
David Sturrock.
George Laing.
J. M. Howden.
Robert Porter.
Sir John Sibbald, F.R.C.P.E., F.R.S.E.
Mrs. Cossar.
John Crombie.
Sir James Guthrie, P.R.S.A.
T. I. S. Roberts.
W. Porteous.
Miss Currie.
Miss Winnifred Littlejohn.
Robert Cochrane.
J. R. P. Wardlaw.
Robert Taylor Skinner, M.A., F.R.S.E.
Thomas Archer Nelson.
Lady M'Clure.
Very Rev. James Mitchell, M.A., D.D.
Richard Brown, C.A.
Sir Colin George Macrae.
William Baird, F.S.A. Scot.
The Rt. Hon. the Earl of Mansfield.
J. J. Dobbie, D.Sc.
Robert Barclay Pearson.
Alexander Ingram.
Ernest M. Lennie.
George Fyfe, M.D.
James P. Gibson.
William Garden.
William Watson.
Harold Raeburn.
E. J. Cuthbertson, W.S.
Chas. H. Urmston, W.S.
Miss M. N. Allan.
Dr. George Henderson.
James A. Hope.
Henry Beveridge.
Miss E. M. Fergusson.
Stevenson Macadam, F.I.C.
Wm. Garson, W.S.
David Meiklereid.
George Todd.
Thos. W. Cuthbertson.
Jas. M'Farlane, J.P.
Thomas Barker.
Rev. Archibald Prentice.
Henry Martyn Clark, M.D., C.M.
Wm. Robertson.
A. E. Stephen, J.P.
Jas. Kirkhope.
John Hogg.
George H. B. Hill.
R. S. M'Nair.
Robert H. N. Sellar.
Miss Alice Paterson.
Fred. J. Stephen, M.A.
Arthur Kay.
J. D. Hedderwick, J.P., D.L.
Jas. J. MacLehose.
James MacGregor.
William Mitchell-Thomson.
Colonel Lord Playfair.
Robert Maule.
Robert Hendry.
A. P. Laurie, M.A., D.Sc., F.R.S.E.
George W. Macfarlane.

The Council agreed to approve and confirm the awards of the Livingstone medal and the Honorary membership of the Society to Commander Peary, U.S. Navy, for his distinguished services in connec-

tion with North Polar Exploration in the years 1898-1902. The Council also agreed to confer the Society's silver medal on Mr. H. J. Mackinder on account of his distinguished services to Geographical Science and Education. The draft Annual Report for the year 1902-3 was read and approved.

Meetings in November.

On November 12 the Anniversary Meeting of the Society was held in the Synod Hall, when the Chair was taken by Sir John Murray, K.C.B., President of the Society. The lecturer was Commander Peary, U.S. Navy, and the subject of his address was "North Polar Exploration in the years 1898-1902." In introducing the lecturer, Sir John Murray referred to his former visit to Scotland with Mrs. Peary six years ago, when he was presented with the ordinary medal of the Society. On the present occasion he had to present to Commander Peary the Livingstone Gold Medal, and to announce that the Society had created him an Honorary Member. Sir John Murray then referred to the fact that this was the last of the Anniversary Meetings at which he would preside, as his term of office expires this session. After having presented the Livingstone Medal to Commander Peary, Sir John Murray called upon him to deliver his address, which will be found in the present issue of the *Magazine*. At the conclusion of his address, Commander Peary alluded to his intention to make another attempt upon the Pole. He hopes to start for the North next July, and if the season is favourable he expects to have his ship by September 1, 1904, on the northern shore of Grant Land. Wintering there, he will start with the first of the returning daylight in the following February on his journey across the Polar pack. A vote of thanks to the lecturer was moved by Sir Colin Macrae, and was responded to in a few words by Commander Peary, after which the Meeting terminated.

Commander Peary repeated his address to the Glasgow Branch on November 13, in the Queen's Rooms, when the Chair was taken by Robert Gourlay, Esq., LL.D.

On the 25th November, in the Society's Rooms, Mr. H. J. Mackinder, M.A., Reader in Geography in the University of Oxford, delivered an address on the "Material Resources of the British Empire," at which Sir John Murray, K.C.B., LL.D., presided, and the Society's silver medal was presented to Mr. Mackinder for his distinguished services to Geographical Science and Education.

On the 23rd November, Lieut. Shackleton, R.N.R., delivered the Anniversary Address in the Kinnaird Hall, Dundee, Mr. R. B. Don in the Chair. The subject of the address was "With the *Discovery* in Antarctica."

On the 25th November, Lieut. Shackleton, R.N.R., delivered the Anniversary Address in the Union Hall, Aberdeen. The subject was the same as in Dundee, Mr. John Clarke being in the Chair.

Scottish National Antarctic Expedition.

A subscription of £50 to the funds of this expedition has been received from Dr. J. M. Barrie.

In our last issue, owing to a misprint, it was stated that the sum of £12,000 was required to carry on the work of the expedition until the eturn of the ship; the sum required for this purpose is £1200.

The Annual Business Meeting

was held on the 19th November in the Society's Hall. Sir John Murray, K.C.B., LL.D., President of the Society, in the Chair.

Sir John Murray, K.C.B., LL.D., was re-elected President. The Vice-Presidents were also re-elected, and the Earl of Mansfield, Col. Lord Playfair, and Lord Stormonth Darling were elected to the office of Vice-President. The following Members of Council who retire by rotation were re-elected, viz.:—Sir Alexander Christison, Bart., Dr. D. F. Lowe, Mr. W. B. Blaikie, Capt. Livingstone Bruce, Col. Cadell, V.C., Col. Wardlaw Ramsay, Dr. George Smith, C.I.E., Mr. A. Crosbie Turner, Dr. Dyer, Mr. R. S. Allan, Dr. George Baxter, and Sir John Farquharson, Bart. The following Members of the Society were elected to fill vacancies in the Council, viz.:—Col. Bailey, R.E., Professor Wallace, Dr. Johnston, Brig.-Surg. Lieut.-Col. Arnott, Dr. Horne, Dr. Gourlay, Dr. J. C. Buist, and Professor J. Arthur Thomson. The Chairmen of the Aberdeen and Dundee Branches were re-elected, and Mr. W. F. G. Anderson was elected Chairman of the Glasgow Branch in room of Dr. Paul Rottenburg, who has resigned.

Col. Bailey, R.E., was elected Honorary Treasurer in room of Mr. Wm. C. Smith, K.C., who retires. Mr. Wm. C. Smith was elected Trustee in room of Professor Butcher, who retires. Certain changes in the Aberdeen Committee were approved.

The Acting Secretary then read the Annual Report of the Council, and the Chairman moved its adoption. He considered it on the whole satisfactory, although he should have been glad had he been able to congratulate the members on a much more rapid increase of the Society in all directions. He thought it could well be obtained if they were to hustle, in the American sense, a little more than they did. It was a matter of regret that they had lost their Secretary, who had served them so well during the past twelve years. It was within his knowledge that Col. Bailey had taken a great deal of pains to provide them with an excellent series of lectures during that period, and he had also made some robust and vigorous attempts to do well for the Society in other directions—to get money to try to house them in a new building, and to present the claims of the Society whenever an opportunity arose. The President then referred to the Report of the Committee on the Board of Manufactures, remarking that it was certainly a satisfaction to know that the report suggested that the rent which the Society paid to the Board of Manufactures should be remitted. To his mind, however, that was not enough. He urged on the meeting the expediency of organising a general and united effort on the part of all scientific men and societies in Scotland to secure that the whole building in the Mound should be given over for the purposes of science to the representatives of Scottish science. The motion was seconded by Mr. Ralph Richardson, who pointed out that £55,900 had been raised by the Society since it was founded for the advancement of the science of geography. The motion was carried unanimously. A vote of thanks to the Chairman was carried by acclamation on the motion of Dr. Burgess, C.I.E.

The meeting then terminated.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Nineteenth Session, 1902-1903.

The Council has the honour to submit the following Report :—

Membership.

The changes which occurred during the Session in the number of members were as follows :—

Number on 1st November 1902, ...		1316
New members added, ...		92
		1408
Deduct by Death, ...	13	
„ Resignation, ...	21	
Struck off the roll (subscriptions in arrear), . .	2	
		36
Number remaining on 31st October 1903, . . .		1372

Of this number, 789 are on the Edinburgh list, 250 are on the Glasgow list, 108 and 83 are on the Dundee and Aberdeen lists respectively. In addition to those on the lists named, 45 members reside abroad, and 97 reside in England. Of the total number of 1372 members, 256 are life members.

The Council regret the resignation of Professor Butcher, who has resigned the office of Trustee, having left Edinburgh for London. They also greatly regret the resignation of Colonel Bailey, R.E., who has so ably and zealously filled the office of Secretary for twelve years.

Finance.

The Council begs to submit the Annual Financial Statement.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1902 to 31st October 1903.

FUNDS AT CLOSE OF LAST ACCOUNT:—			
£1000 Glasgow and South-Western Railway Company 4 per cent. Funded Debt, at cost, as at 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost, as at 30th December 1890,		496 2 0	
£300 New Zealand Government 3½ per cent. Inscribed Stock, at cost, as at 30th May 1894,		301 9 10	
£200 Great Central Railway Company 4½ per cent. Debenture Stock, at cost, as at 31st December 1898,		312 2 9	
		£2212 14 4	
BALANCE due by Bank of Scotland, in Account Current,	£76 0 9		
BALANCE due by Secretary,	0 7 5		
		76 8 2	
		£2289 2 6	
SUM advanced to Livingstone Medal Fund during last Account,		0 11 6	
		£2289 14 0	
SUBSCRIPTIONS from Ordinary Members,	£1225 7 0		
Do. do. Life Members,	40 0 0		
DIVIDENDS and INTEREST,	80 1 0		
		1345 8 0	
PROFIT on Sale of New Zealand Stock,		11 7 8	
		£3646 9 8	

MAGAZINE—Expenses of Publication, etc., from Nos. 10 to 12 of Vol. XVIII., and Nos. 1 to 9 of Vol. XIX.:—			
Printing and other charges,			£465 6 9
Illustrations,			25 8 6
Maps,			51 6 6
			£542 1 9
Less—			
Magazines sold,	£65 0 5		
Advertising Receipts, less Payments,	11 3 11		
		76 4 4	
			£465 17 5
GENERAL PRINTING,			37 5 7
LIBRARY—Books and furnishings,	£7 1 11		
Less Receipts by sale of books,	0 10 6		
		6 11 5	
RENTS OF HALLS, and other expenses of Lectures,	£318 1 0		
Less Lecture Tickets sold,	138 16 10		
		179 4 2	
GLASGOW BRANCH, Rent of Hall, attendance, and General Expenses,		35 18 1	
RENT OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,		127 9 4	
SALARIES:— Secretary,	£200 0 0		
Editor and Clerks,	185 16 0		
		385 16 0	
MISCELLANEOUS, including Stationery, General Expenses, Postages,		44 0 5	
MEDAL,		3 5 7	
FUNDS AT CLOSE OF THIS ACCOUNT:—			
£1000 Glasgow and South-Western Railway Company 4 per cent. Funded Debt, at cost, as at 29th May 1885,	£1102 19 9		
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost, as at 30th December 1890,	496 2 0		
£200 Great Central Railway 4½ per cent. Debenture Stock, at cost, as at 31st December 1898,	312 2 9		
£240 North British Railway Company 4 per cent. Consolidated Preference Stock, at cost, as at 11th December 1902,	306 8 9		
	£2217 13 3		
BALANCE due by Bank of Scotland:—			
1. On Account Current, £33 10 3			
2. On Deposit Receipt, 54 19 5			
	88 9 8		
BALANCE due by Secretary,	54 4 2		
BALANCE due by Livingstone Fund,	0 14 7		
		2361 1 8	
		£3646 9 8	

Edinburgh, 16th November 1903.—I have examined the Accounts of the Royal Scottish Geographical Society for the year ending 31st October 1903, of which the

LIVINGSTONE MEDAL FUND.

FUNDS AT CLOSE OF LAST ACCOUNT:—			
£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,		£999 11 6	
Sums on Deposit Receipt with Bank of Scotland, Greenside Branch:—			
Lodged 7th April 1902,	£14 8 7		
Do. 16th October 1902,	14 9 3		
		28 17 10	
		£1028 9 4	
Less Sum advanced from General Funds of Society,		0 11 6	
		£1027 17 10	
Income received—			
1. Dividend on £770 North British Railway Company 4 per cent. Preference Stock No. 1—			
For half-year to 31st January 1903, £15, 8s., less tax,	£14 8 9		
For half-year to 31st July 1903, £15, 8s., less tax,	14 12 1		
	£29 0 10		
2. Interest on Deposit Receipts uplifted,	0 4 1		
		29 4 11	
		£1057 2 9	

Paid Messrs. Kirkwood for Medal,			£29 5 0
Funds at close of Account—			
£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,		£999 11 6	
Sums on Deposit Receipt with Bank of Scotland, Greenside Branch—			
Lodged 19th June 1903,	£14 8 9		
Do. 19th October 1903,	14 12 1		
		29 0 10	
		£1028 12 4	
Less Sum due to General Fund,		0 14 7	
			1027 17 9
Whereof:—Capital,		£1000 0 0	
Income,		27 17 9	
		£1027 17 9	
			£1057 2 9

Edinburgh, 16th November 1903.—Examined and found correct.—HUGH BLAIR, C.A.

Livingstone Gold Medal.

The second Livingstone Gold Medal was awarded by the Council to Dr. Sven Hedin, for his distinguished services as an explorer in Central Asia. The Society's Silver Medal was conferred upon Captain Otto Sverdrup, in consideration of the discoveries made by his Arctic Expedition during the years 1898-1902.

Meetings.

The Society's Anniversary Meeting was addressed by Dr. Sven Hedin. Twenty-five ordinary Meetings were held, eleven of them in Edinburgh, five in Glasgow, five in Dundee, and four in Aberdeen. These meetings were addressed by Mr. Harry de Windt, Captain C. H. D Ryder, Captain Richard Steele, Mr. W. Albert Hickman, Mr. C. H. Hawes, M.A., B.Sc., Mr. J. S. Flett, M.A., D.Sc., Dr. A. J. Herbertson, Dr. W. G. Smith, Mr. H. M. Cadell, Captain Otto Sverdrup, and Mr. Arthur Gulston.

The Society's Magazine.

The Scottish Geographical Magazine has, as usual, been published monthly throughout the past Session.

The Council is glad to acknowledge its obligation to the contributors of articles, and to the following gentlemen who have rendered valuable assistance to the Editors:—The Hon. J. Abercromby, Colonel Bailey, J. G. Bartholomew, Alex. Begg, W. B. Blaikie, Rev. J. Bryant, Victor Dingelstedt, Dr. Felkin, J. C. Ferrier, H. B. Finlay, Professor J. Geikie, Dr. J. Gunn, Dr. J. Scott Keltie, Rev. Robert Mackenzie, Ralph Richardson, Kenneth Sanderson, Colonel Sconce, Dr. W. G. Smith, and W. B. Wilson.

Library and Map Department.

During the past Session 205 books, 28 pamphlets, 107 reports, 6 atlases, 329 map-sheets, and 123 charts have been added to the library. The number of volumes borrowed by members was 1206; and the library was, as usual, much consulted by non-members in search of Geographical information. The expenses of the library amounted to £7, 1s. 11d.

The Council desires to record its thanks to foreign and Colonial Governments for the official publications they have presented to the library; and also to the undermentioned private donors of books and maps, viz.:—A. de Gerlache, Dr. J. Scott Keltie, Dr. George Smith, Erskine Beveridge, Dr. M. A. Stein, Dr. A. J. Herbertson, Edward Whymper, the Royal Geographical Society, and the British Museum.

Scottish Antarctic Exploration Fund.

The following additional subscriptions have been received, viz.:—

Robert M'Vitie,	£50	0	0
John Rutherfurd,	5	5	0
J. D. Munro,	2	2	0
Misses Harvey,	5	0	0
Lord Lamington,	2	2	0
Miss Jane Hay,	5	0	0
General Cockburn,	1	0	0

The entire sum in the Secretary's hands has been paid over to the Honorary Treasurer to the Expedition.

Report by Government Committee.

The Departmental Committee appointed by the Secretary for Scotland to inquire into the Board of Manufactures, reported last August that the rent of £120 paid by the Society to the Board ought to be remitted.

The Society's Branches.

The Council has again the pleasure to acknowledge the services rendered by the honorary officials of the Society's Branches at Glasgow, Dundee, and Aberdeen.

MAPS SHOWING DISCOVERIES OF COMMANDER PEARY'S EXPEDITION, 1900-2

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